Chemical Engineering Undergraduate Handbook

2016-2017 Edition

Contains information and where/how to get additional information of concern to the undergraduate student in the Department of Chemical Engineering.

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Introduction

This handbook has been prepared to help you plan your program in Chemical Engineering at Kansas State University. It is intended to guide you through the chemical engineering curriculum, to describe various opportunities and study options, and to relay important policies and procedures. Other important sources of information are:

the Undergraduate Catalog for curriculum and course information
(http://courses.ksu.edu/catalog/undergraduate/)

the Schedule of Classes published three times each year
(http://courses.k-state.edu/)

the KSU Information Handbook for academic regulations
(http://courses.ksu.edu/catalog/undergraduate/regulations/)

the *Manhattan Mercury*
(http://www.themercury.com/)

the undergraduate bulletin board by Room 1029 Durland Hall

the Engineering Student Services Office in Room 1093 Fiedler Hall

the Chemical Engineering Department Office in Room 1005 Durland Hall
(http://www.che.ksu.edu)

Part I: General Information

The Profession of Chemical Engineering

Chemical engineering is an exciting and diverse profession with a tremendous range of occupations and opportunities. Chemical engineers have always been proud of their flexibility. A solid and very general technical background enables them to work effectively in and adapt quickly to many different fields.

The chemical engineer is an expert at dealing with the chemical and physical changes of matter and with the conversion of energy. Most chemical engineers use this knowledge in jobs that involve the application of chemical research to the production of chemical materials and products. This entails product development and market research, economic feasibility studies, research, development and design of chemical processes, design of process equipment, supervision of the construction, start-up, operation and maintenance of chemical plants, and process improvement for pollution control and energy conservation.

Chemical engineers are found working in such diverse areas as business, applied physics, manufacturing, applied mathematics, biochemistry, medicine, patent law, food processing, pollution monitoring and prediction, sales, and industrial management. All of these are in addition to the already wide range of types of jobs traditionally thought of as chemical engineering jobs.

Chemical engineers are employed in a wide variety of industries: petroleum and gas, chemicals, minerals and metals, glass and ceramics, plastics and resins, soap and detergents, cosmetics, rubber and tire, food production, fertilizer and agricultural chemicals, nuclear energy, photographic products, microchip manufacturing, missile and space, synthetic fibers and textiles, paint, paper and cellulose, pharmaceuticals, and process equipment manufacture. They are also involved in private consulting, government and higher education.

The American Institute of Chemical Engineers' web address for career information is: http://www.aiche.org

Chemical Engineering Facilities

Durland Hall, which is open from 7 a.m. to 12 midnight Monday-Thursday, 7 a.m. to 9 p.m. Friday, 8 a.m. to 6 p.m. on Saturday, and 10 am to midnight on Sunday, houses classrooms, computer lab and study room, research and teaching laboratories, and departmental and staff offices. You are invited to stop in at any of the research labs and ask about the research work in progress.

Department Administration
The department office and the office of the Department Head are located in 1005 Durland Hall. The department office telephone number is 532-5584. The Engineering Student Services Office is located in 1093 Fiedler Hall; the telephone number is 532-5592.

Computers

The Chemical Engineering Department Computer Lab is devoted to undergraduate student use. There are 12 Dell OptiPlex 9020 computers in Durland 1039 and 21 Dell Precision workstations in Durland 1040. These computers all have 4th or 6th generation i7 processors, ranging from 3.4ghz to 3.6ghz, with 8gb or 16gb of RAM. All of the computers are on current generation Solid State Drives to maximize their performance. Also available for student use are 2 Dell B5460dn black and white printers, and a Dell Color 2155cdn printer. All of the computers are running 64bit Windows 10 operating systems, are on the high-speed wired network, and connected to the College of Engineering Active Directory services domain. They have many applications installed specific to ChE courses, as well as other helpful Engineering and productivity software packages (a current list of software can be viewed at http://cecs.engg.ksu.edu/labs/software).

INSTALLATION OF PERSONAL SOFTWARE IS PROHIBITED ON THESE MACHINES

As a new member of the K-State community, you must register and select an eID, your K-State electronic identification. Your eID is part of your e-mail address and your key to the resources on K-State's central computer systems.

To select your eID: https://eid.k-state.edu/eProfile/registration.do

An Engineering student will generally have an engineering account created automatically upon entering their freshman year, but activation of the account for use in the Durland Computer Lab may be necessary in some cases (e.g. changes of major). If you are unable to login using your engineering account, visit http://password.engg.ksu.edu/ to reset your password. If you need further assistance, contact College of Engineering Computing Services, support@engg.ksu.edu, 532-4643, or visit them in Room 30 Seaton Hall and a computer tech there should be able to assist you.

These machines have a variety of software installed upon them, including Microsoft Office 2000, SSH, SFTP, Norton Anti-virus, MathCAD, and ChemCAD.

Support: Please report computer and printer malfunctions to the College of Engineering Computing Services, support@engg.ksu.edu, 532-4643. K-State eID related issues can be reported to eID@k-state.edu (or contact the K-State IT Help Desk at (785) 532-7722), as well.

Release of Student Information

In this department we routinely get requests from employers and graduate schools to provide names of potential candidates to aid them in their recruitment. We will provide such lists, with directory information, unless you request that we not include you in such releases. We do not release individual GPA information unless the student has authorized the organization to request it. You may request exclusion by submitting a written request to the Registrar's Office, 118 Anderson Hall. The Registrar's Office will notify other appropriate University Offices. http://www.k-state.edu/registrar/ferpa/consent-to-disclose.pdf. Or you may complete the Non-Disclosure Form at the following website:

http://www.k-state.edu/registrar/ferpa/Non_Disclosure_info.html

Advising

Shortly after enrolling in CHE 110, you will be assigned to a faculty advisor who will be your initial point of contact for most advising issues. Your faculty advisor will help you with routine matters such as degree audit corrections, answering policy/procedure questions, handling scheduling difficulties, and guiding you to campus resources. You will also see your faculty advisor for registration advising (registration deadlines are given at the beginning of the booklet) and to pick up registration materials. You should visit with your faculty advisor to discuss your progress and academic goals, for choosing a package of electives, for help in formulating career goals, for answers to questions about the profession of chemical engineering, for help in applying to graduate school, and for any other issue that requires faculty expertise.

If you feel a need to change advisors, you should discuss the matter with the department head.

Your faculty advisor is the primary source for:

- Developing an elective package
- How to add or drop a course, or register
- Information about the profession
- Career and profession issues
- Working on a degree program
- Resolving course scheduling problems
- Discussing undergraduate independent study projects
- Help in deciding whether to add or drop a course

The ChE Office Staff in 1005 Durland Hall can help with:

- How to add or drop a course, or register
- Getting copies of forms you need
- Information about degree requirements
- Finding another advisor if yours is unavailable

Two useful tools exist to assist you with academic advising. The first is the curriculum flow chart for chemical engineering. Once activated, this provides an individualized, visual tool for you and your advisor to monitor your progress through the curriculum. You access the flow chart through the College of Engineering Advising website (http://www.engg.ksu.edu/studentservices/advising) or at http://flowcharts.engg.ksu.edu/ . The other tool with which you should become very familiar is DARS. It is a tool provided by the university that assesses which of your course requirements have been completed, are in progress, or remain to be completed. It is worth your effort to become familiar with DARS and how to read a DARS report. You access your DARS report through the KSIS system.

Academic Integrity

It is imperative that society be able to rely upon the integrity of the members of our profession. At the university, the faculty expects students to follow high ethical standards in their academic work. Rules and procedures regarding actions which constitute academic dishonesty are included in the Kansas State University Handbook (http://www.k-state.edu/provost/universityhb/). These apply to all students. In addition, the chemical engineering faculty has adopted the following policy statement which applies in chemical engineering courses.

> *The faculty expects that work submitted in your name be entirely your own work. You should not copy assignments, exams, quizzes, computer programs, etc., from others or allow copying of your work. It is usually permissible to discuss homework assignments with other students, unless your instructor specifies to the contrary. For examinations and quizzes a stricter standard is imposed. For exams and quizzes the presumption, unless otherwise stated, is no discussion, no use of notes, no use of books or journals, and no use of work of others. If in a particular instance the instructor wishes to modify any part of the department policy, you will be so informed in writing.*

American Institute of Chemical Engineers (AIChE) Code of Ethics

Members of the American Institute of Chemical Engineers shall uphold and advance the integrity, honor and dignity of the engineering profession by: being honest and impartial and serving with fidelity their employers, their clients, and the public; striving to increase the competence and prestige of the engineering profession; and using their knowledge and skill for the enhancement of human welfare. To achieve these goals, members shall:

- Hold paramount the safety, health and welfare of the public and protect the environment in performance of their professional duties.

- Formally advise their employers or clients (and consider further disclosure, if warranted) if they perceive that a consequence of their duties will adversely affect the present or future health or safety of their colleagues or the public.

- Accept responsibility for their actions, seek and heed critical review of their work and offer objective criticism of the work of others.

- Issue statements or present information only in an objective and truthful manner.

- Act in professional matters for each employer or client as faithful agents or trustees, avoiding conflicts of interest and never breaching confidentiality.

- Treat fairly and respectfully all colleagues and co-workers, recognizing their unique contributions and capabilities.

- Perform professional services only in areas of their competence.

- Build their professional reputations on the merits of their services.

- Continue their professional development throughout their careers, and provide opportunities for the professional development of those under their supervision.

- Never tolerate harassment.

- Conduct themselves in a fair, honorable and respectful manner.

Part II: Curriculum & Requirements

MISSION of the DEPARTMENT OF CHEMICAL ENGINEERING

March, 2005

The mission of the chemical engineering undergraduate program is to produce graduates who strive to better the human condition throughout the world by application of their technical knowledge and professional skill.

CHE UNDERGRADUATE PROGRAM EDUCATIONAL OBJECTIVES

In consultation with the stakeholders for our baccalaureate program, the Department of Chemical Engineering has established the following program objectives. The version reported here was accepted in final form in March 2005.

As engineers, the graduates of the Department of Chemical Engineering:

- Will be well grounded in the fundamentals of chemical engineering so as to be prepared for the spectrum of career opportunities available to them;

- Will have developed the professional skills, such as communication, teamwork and engineering ethics, necessary to practice their profession in a diverse world;

- Will be capable of meeting the challenges of a world characterized by rapidly increasing technical complexity;

- Will have an awareness of the impact of technology on society;

- Will contribute both to society in general and to their profession in particular; and,

- Will become life-long learners and will compete favorably should they decide to pursue advanced studies.

PROGRAM OUTCOMES

Undergraduate Program Outcomes of the Department of Chemical Engineering

March, 2005

Graduates of the Chemical Engineering Department at Kansas State University will have:

- an ability to apply knowledge of mathematics, science, and engineering,
- an ability to identify, formulate, and solve engineering problems,
- an ability to design and conduct experiments, as well as to analyze and interpret data,
- an ability to design a system, component, or process to meet desired needs,
- an ability to function on multi-disciplinary teams,
- an understanding of professional and ethical responsibility,
- an ability to communicate effectively,
- the broad education necessary to understand the impact of engineering solutions in a global and societal context,
- a recognition of the need for, and an ability to engage in, life-long learning,
- a knowledge of contemporary issues, and
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Basic Program Requirements

Engineering students are required to complete certain basic courses as a condition of enrollment in engineering courses at the 200-level or above. The general requirement is to complete the basic engineering program with a grade point average of 2.00 or better. The basic program courses are:

MATH 220, 221	CHEM 210, 230
ENG 100	ECON 110
SPCH 105	DEN 015
CHE 110, 015	

Prior to satisfying the basic program requirement, a chemical engineering student may (if otherwise qualified) enroll in 200-level or above engineering courses for no more than two semesters.

For transfer students, enrollment is permitted for no more than two semesters prior to satisfying the basic program requirement. For transfer students, certain waivers and substitutions are possible and should be discussed with the academic advisor as early as possible.

Design Experience

The *design experience* begins in the second year in CHE 320, Chemical Process Analysis, a basic course in material and energy balances, and CHE 416, Computational Techniques in Chemical Engineering, in which students are introduced to the design and computation tools that will be used in subsequent courses, including a programming language, databases, data manipulation and reduction, and the use of numerical method packages. The design experience then continues through the sequence of primarily engineering science courses — fluid mechanics, heat transfer, mass transfer, thermodynamics, reaction engineering, and process control. In each of these courses there is at least one organized design experience.

Meanwhile, in the parallel two-semester sequence of chemical engineering laboratory courses there is a significant emphasis on the design process. The senior courses, in particular CHE 550 which concentrates on chemical reactions and related processing and CHE 560 which focuses on separation processes. Both courses include design experiences. Finally, the capstone design course, CHE 570 and CHE 571, brings together all of these elements in an integrated design experience, along with the concepts of optimization and economic design.

The overall plan is to distribute the process of learning to design chemical engineering processes, products, and systems throughout the curriculum in a continuous experience.

Electives

The chemical engineering curriculum provides considerable flexibility, which allows students to tailor the curriculum to meet their own needs. The elective requirements include both social

sciences and humanities subjects and technical or scientific topics.

The chemical engineering curriculum includes 17 credits of technical electives to encourage students to develop an "area of emphasis." For example, a student may wish to take courses that will be good preparation for graduate school, or a student may wish to develop a stronger background in environmental engineering, biochemical engineering, biotechnology, or solid state (electronic or polymeric) materials processing. Be sure to plan early enough to permit taking necessary prerequisites. Suggestions for areas of emphasis are listed on page 15. Examples of how the curriculum can be tailored to specific areas of emphasis can be found at the following site on the department's web page: http://www.che.ksu.edu/undergrad/degrees/

The various elective requirements are listed in Table I.

Table I - Electives

SUBJECTS ARE		MINIMUM CREDITS
Humanities and Social Science Course List These courses are to be selected from the list approved by the College of Engineering. At least 6 hours of 300-level or higher UGE courses must be included within these 15 hours. All courses must be taken for a letter grade.		**15**
Technical Electives		**17**
Chemical Engineering Electives. These include any CHE course not specified in the curriculum.	3	
Chemistry/Biochemistry/Biology Electives. CHM 550, 566, 585, BIOCH 521, 590, 755, 765, BIOL 450, 455, 500, 529, 541.	3	
Advanced Laboratory Experience Electives. CHM 532, 596, BIOCH 522, 756, BIOL 455 (Lab courses must be a continuation course of prior or existing courses.)	2	
Professional Electives. The remaining hours of technical electives are to be selected to enhance the student's professional development. At lease one course selected from either analytical mechanics (both statics and dynamics must be represented; CE 333 and ME 512, or CE 530) or circuits, fields, and electronics (EECE 510 or EECE 519) must be included.	9	

Chemical Engineering Electives
(Suggested courses or see catalog)

CHE 497. Undergraduate Research in Chemical Engineering. (VAR) I, II, S. An introduction to chemical engineering research. Pr. Consent of instructor.

CHE 499. Honors Research in Chemical Engineering. (Var.) I, II. Individual research problem selected with approval of faculty advisor. Open to students in the College of Engineering honors program. A report is presented orally and in writing during the last semester.

CHE 580. Problems in Chemical Engineering or Materials Science. (Var.) I, II. S. An introduction to chemical engineering research. Pr.: Approval of department head.

CHE 626. Bioseparations. (2) II. In even years. Study of separations important in food and biochemical engineering such as leaching, extraction, expression, absorption, ion exchange, filtration, centrifugation, membrane separation, and chromatographic separations. Two hours rec. a week. Pr.: CHE 531 or AGE 575.

CHE 648. Process of Composite Materials. (3)I, II. Principles of composite materials, including ceramic, metal, and polymer matrix composites; properties and processing of fibers; role of interfaces in composites; basic concepts in mechanics, failure, and testing of composite materials. Three hours lec. A week. Pr.: CHE 350 or 352.

CHE 650. Hazardous Waste Engineering Seminar. (1) I, II. S. Topics in hazardous materials management and control, waste reduction and minimization, hazardous substance tracking, and hazardous waste engineering. One hour rec. a week. Pr.: CHM 230.

CHE 661. Process of Materials for Solid State. (3) I, II. Structure, properties, and processing of materials for solid state devices. Crystal growth, epitaxy, oxidation, diffusion, lithography, and etching as applied to device fabrication. Three hours rec. A week. Pr.: CHE 350 or 352.

CHE 681. Engineering Materials II. (3)I, II. S. The structure and bonding in crystalline and amorphous materials; crystallography; thermodynamic stability in materials, equilibrium diagrams and the phase rule; rate theory and kinetics of solid-state transformation; mechanical behavior of engineering materials; dislocations; failure mechanisms. Three hours lec. a week. Pr.: CHE 350 or 352.

CHE 682. Surface Phenomena. (2)I, II, S. Principles and applications of interfacial phenomena, including capillarity, colloids, porosity, adsorption, and catalysis. Two hours rec. a week. Pr.: CHE 520.

CHE 715. Biochemical Engineering. (3) I. The analysis and design of biochemical processing systems with emphasis on fermentation kinetics, continuous fermentations, aeration, agitation, scale up, sterilization, and control. Three hours rec. a week. Pr. or conc.: CHE 550.

CHE 725. Biotransport Phenomena. (3)I, II. Principles of transport phenomena applied to biological and physiological processes. Membrane transport processes, circulatory system transport phenomena, transport and distribution of drugs. Pr.: CHE 530.

CHE 735. Chemical Engineering Analysis I. (3)I, II. The mathematical formulation of problems in chemical engineering using partial differential equations, vector and tensor notation. Solution of these problems by analytical and numerical methods. Three hours rec. a week. Pr.: CHE 530.

CHE 750. Air Quality Seminar. (1) I. Topics in air quality including health effects, toxicology, measurement, characterization, modeling, management, and control. One hour rec. a week. Pr.: CHE 230.

CHE 768. Geoenvironmental Engineering Design. (3) II. A team design project in geoenvironmental engineering focused on resolving interdisciplinary issues related to containment of pollutants and remediation of soil and groundwater. Pr.: One of the following: AGRON 605, AGRON 746, BAE 690, CE 625, CE 654, CHE 531, GEOL 611.

Chemistry/Biochemistry/Biology Electives
(Suggested courses or see catalog)

Chemistry

CHM 532. Organic Chemistry Laboratory. (2) I, II. One five-hour lab and one hour of lec. a week. Pr.: CHM 550 or conc. Enrollment.

CHM 550. Organic Chemistry II. (3) I, II. A continuation of Organic Chemistry I (CHM 531). CHM 550 represents the second semester of a two-semester survey of organic chemistry. Topics to be discussed include syntheses, reactions, and mechanisms of alkynes, aldehydes and ketones, carboxylic acids and their derivative, amines, benzene and its derivatives, organometallic chemistry, conjugated unsaturated systems and pericyclic reactions, polymers, carbohydrates, lipids, amino acids, proteins, and nucleic acids. Structural identification will be studied using various current spectroscopic methods. Three hours lec. A week. Pr.: CHM 531.

CHM 566. Instrumental Methods of Analysis. (3) I. Introduction to theory and practice of electrochemical methods, molecular and atomic spectroscopy, surface science, mass spectrometry, separation methods, and electronics in analytical chemistry. Three hours lec. A week. Pr.: CHM 531 and either CHM 500 or 585.

CHM 585. Physical Chemistry I. (3) I. Elementary chemical thermodynamics and kinetic theory of gases. Three hours lec. A week. Pr.: CHM 350 or 531, MATH 222 and PHYS 214.

CHM 596. Physical Methods Laboratory. (1-2) II. Experiments that relate to physical and instrumental methods. Three to six hours lab a week. Pr.: MATH 221, PHYS 114 or 214.

Biochemistry

BIOCH 521. General Biochemistry. (3) I, II, S. A basic study of the chemistry and metabolism of carbohydrates, lipids, proteins, and nucleic acids. Pr.: CHM 350.

BIOCH 522. General Biochemistry Laboratory. (2) I. II. S. A one-semester laboratory course with experiments relating to carbohydrates, lipids, proteins, nucleic acids, and enzymes, Six hours lab a week. Pr.: CHM 351 and BIOCH 52 or conc. enrollment, or BIOCH 755 or conc. enrollment.

BIOCH 590. Physical Studies of Biomacromolecules. (3) II. An overview of concepts and techniques of physical science used in studying the structure and function of biomacromolecules such as proteins and DNA. Applications include classical equilibrium thermodynamics and spectroscopic methods, including mass spectrometry, circular dichroism (CD), and nuclear magnetic resonance (NMR). Pr.: CHM 500, MATH 221, and PHYS 114.

BIOCH 755. Biochemistry I. (3) I. An introduction to physical methods, kinetics and thermodynamics of biochemical reactions and bioenergetics, chemistry of proteins and amino acids, carbohydrate chemistry, and metabolism. BIOCH 755 and 765 are for students interested in a two-semester comprehensive coverage of biochemistry. For a one-semester course, enroll in BIOCH 521. Pr.: *Chemical analysis, one year of organic chemistry, differential and integral calculus.

BIOCH 756. Biochemistry I Laboratory. (2) I. An intensive laboratory course to accompany BIOCH 755. BIOCH 756 and 766 are sequential courses for students interested in a two-semester comprehensive coverage of experiments in biochemistry. For a one-semester laboratory course, enroll in BIOCH 522. Six hours lab a week. Pr.: *BIOCH 755 or conc. enrollment.

BIOCH 765. Biochemistry II. (3) II. Continuation of BIOCH 755; lipid chemistry and metabolism, amino acid metabolism, nutrition, nucleic acid chemistry and metabolism, integration of biochemical pathways and metabolic control mechanisms. Pr.: *BIOCH 755.

Biology

BIOL 450. Modern Genetics (4). I. II. An introduction to the principles and mechanisms of inheritance at both the organismic and molecular levels. Provides an integrated approach to transmission genetics and the fundamentals of molecular biology. Topics covered include Mendelian inheritance, DNA and chromosome structure, gene expression, mutation, recombinant DNA, quantitative inheritance, population, and evolutionary genetics. Three hours lec. And one hour rec./studio. Pr: BIOL 198, CHM 230, MATH 100.

BIOL 455. General Microbiology. (4) I, II. Micro-organisms, their handling, morphology, growth and importance. Two hours lec. And four hours lab a week. Pr.: BIOL 198 and once course in chemistry.

BIOL 500. Plant Physiology. (4) I. Detailed consideration of physiological processes of higher plants. Three hours lec. And three hours lab a week. Pr.: BIOL 201 or 210; and a course in organic chemistry.

BIOL 529. Fundamentals of Ecology. (3) I. Inter-disciplinary examination of organisms and the physical environment, ecosystem structure and function, population ecology and demography, community structure and dynamics, and basic ecological principles and their relevance to contemporary environmental issues. Three hours lec. per week. Pr.: BIOL 198 and CHM 210.

BIOL 541. Cell Biology. (3) I. II. Structure and function of cells and subcellular components. A molecular understanding of membranes and cellular physiology will be emphasized. Three hours lec. Pr.: BIOL 450 and CM 350.

Professional Electives
(Suggested courses or see catalog)

CE 333. Statics. (3) I, II. S. Composition and resolution of forces; equilibrium of force systems; application of general laws of statics to engineering problems, including use of vector algebra, friction and force analyses of simple structures, cables, and machine elements; center of gravity; moments of inertia. Three hours rec. a week. Pr. : MATH 221 and PHYS 213.

CE 530. Statics and Dynamics. (3) I, II. A shortened combined course in (1) statics, including a study of force systems, free-body diagrams, and problems in equilibrium, friction, centroids, and moments of inertia, and (2) dynamics, including a study of kinematics and kinetics of particles and rigid bodies using method of force-mass-acceleration. Three hours rec. a week. Pr.: MATH 222 and PHYS 213.

EECE 510. Circuit Theory I (3) I, II. An introduction to linear circuit theory; analysis of linear circuits containing resistance, inductance, and capacitance. Mutual inductance and transformers. Three hours rec. a week. Pr.: MATH 222, PHYS 214, and EECE 210.

EECE 519. Electric Circuits and Control. (4) I, II, S. Principles of direct-current circuits and machines, alternating-current circuits and machines, electronics, and application to instrumentation and control. Four hour rec. a week. Not open to EECE students. Pr.: PHYS 214.

ME 512. Dynamics. (3) I, II, S. Vector treatment of kinematics, Newton's laws, work and energy, impulse and momentum, with applications to problems of particle and rigid body motion. Three hours rec. a week. Pr.: CE 333 and MATH 222.

Engineering Electives
(see catalog)

Suggested Emphases for Technical Electives (prerequisites & co-requisites)

Listed below are courses that students should consider taking as part of their package of electives for various career paths. These lists are not exhaustive, and sometimes more courses are suggested than a student has time to take. All students should work closely with their advisor to choose an appropriate set of electives to suit their individual career goals.

Bioengineering

ChE/Professional Electives
- CHE 626 (3) Bioseparations
- CHE 715 (3) Biochemical Engineering

Chemistry/Professional Electives
- BIOCH 755 (3) Biochemistry I
- BIOCH 756 (2) Biochemistry Lab
- BIOL 198 (4) Principles of Biology

Engineering Electives
- EECE 519 (4) Electric Circuits and Control
- CE 530 Statics and Dynamics

Chemical Industry

ChE/Professional Electives
- CHE 497 (3) Undergraduate Research
- CHE 682 (3) Surface Phenomena
- CHE 735 (3) Chemical Engineering Analysis I

Chemistry/Professional Electives
- CHM 550 (3) Organic II
- CHM 532 (3) Organic Lab
- CHM 566 (3) Instrumental Methods of Analysis
- CHM 532 (2) Organic Chemistry Laboratory
- BIOCH 521 (2) General Biochemistry Laboratory
- CHM 596 (2) Physical Methods Laboratory

Statistics Electives
- STAT 490 (3) Statistics for Engineers I
- STAT 491 (3) Statistics for Engineers II
- STAT 704 (2) Analysis of Variance

Engineering Electives
- EECE 519 (4) Electric Circuits and Control
- CE 530 Statics and Dynamics

Food

ChE/Professional Electives
- CHE 497 (3) Undergraduate Research
- CHE 626 (3) Bioseparations
- CHE 715 (3) Biochemical Engineering

Food (Continued)

Chemistry/Professional Electives

- BIOCH 521 (3) General Biochemistry
- BIOCH 522 (2) General Biochemistry Lab

Professional/Technical Electives

- GRSC 602 (3) Cereal Science
- GRSC 635 (3) Baking Science I
- GRSC 636 (3) Baking Science I Laboratory

Engineering Electives

- EECE 519 (4) Electric Circuits and Control
- CE 530 Statics and Dynamics

General

ChE/Professional Electives

- Any CHE class not listed separately in this curriculum

Chemistry/Professional Electives

- CHM 550 (3) Organic II
- BIOCH 521 (3) General Biochemistry
- CHM 585 (3) Physical Chemistry I

Engineering Electives

- EECE 510 (3) Circuit Theory I
- EECE 519 (4) Electric Circuits and Control
- CE 333 (3) Statics
- ME 512 (3) Dynamics
- CE 530 (3) Statics and Dynamics

Leadership

ChE/Professional Electives

- Any CHE class not listed separately in this curriculum

Chemistry/Professional Electives

- CHM 550 (3) Organic II
- BIOCH 521 (3) General Biochemistry
- CHM 585 (3) Physical Chemistry I
- CHM 532 (2) Organic Chemistry Laboratory
- BIOCH 521 (2) General Biochemistry Laboratory
- CHM 596 (2) Physical Methods Laboratory

Humanities Elective

Civilization Category

- AMETH 160 (3) Introduction to American Ethnic Studies

Ethics Category

- LAR 322 (3) Environmental Issues and Ethics
- PHILO 365 (3) Medical Ethics
- PHILO 390 (3) Business Ethics

Leadership (Continued)

Organization Behavior Category

PSYCH 425 (3) Problem Solving and Decision Making
PSYCH 560 (3) Industrial Psychology
PSYCH 625 (3) Engineering Psychology

Engineering Electives

EECE 519 (4) Electric Circuits and Control
CE 530 Statics and Dynamics

Foundations Category

DEN 300 (3) Introduction to Total Quality Management
DEN 398 (3) Problems in Engineering and Technology
IMSE 530 (3) Engineering Economic Analysis

Micro-Electronics Materials

ChE/Professional Electives

CHE 497 (3) Undergraduate Research in Chemical Engineering
CHE 661 (3) Processing of Materials for Solid State Devices
CHE 681 (3) Engineering Materials II

Chemistry/Professional Electives

CHM 585 (3) Physical Chemistry I
CHM 596 (3) Physical Methods Laboratory

Engineering Electives

EECE 510 (3) Circuit Theory I
EECE 525 (3) Electronics I
EECE 696 (3) Integrated Circuit Devices and Processes

Professional/Technical Electives

PHYS 325 (4) Physics III, Relativity and Quantum Physics

Pre-Med

ChE/Professional Electives

CHE 626 (3) Bioseparations
CHE 715 (3) Biochemical Engineering

Chemistry/Professional Electives

BIOCH 521 (3) General Biochemistry
BIOCH 522 (2) General Biochemistry Laboratory
BIOCH 755 (3) Biochemistry I
BIOCH 756 (2) Biochemistry I Laboratory
BIOCH 765 (3) Biochemistry II
BIOL 198 (3) Principles of Biology
BIOL 340 (3) Structure and Function of the Human Body

Engineering Electives

EECE 519 (4) Electric Circuits and Control
CE 530 Statics and Dynamics

Undergraduate Curriculum in Chemical Engineering

2007-2008 Catalog

Total Credits = 128

First Year (31)

Fall Semester (15)

0	DEN 015	New Student Orientation
1	CHE 110	Current Topics in Chem. Eng.
4	CHM 210	Chemistry I
3	ENGL 100	Expository Writing I
4	MATH 220	Analytical Geometry and Calculus 1
3		Humanities/Social Sciences Elective
0	CHE 015	Engineering Assembly

Spring Semester (16)

4	CHM 230	Chemistry II
4	MATH 221	Analytical Geometry and Calculus II
3	ECON 110	Principles of Macroeconomics I
3		Humanities/Social Sciences Elective
2	SPCH 105	Public Speaking 1A
0	CHE 015	Engineering Assembly

Second Year (33)

Fall Semester (16)

4	MATH 222	Analytical Geometry and Calculus III
5	PHYS 213	Engineering Physics I
4	CHM 371	Chemical Analysis
3	CHE 320	Chemical Process Analysis 3
0	CHE 015	Engineering Assembly

Spring Semester (17)

4	MATH 240	Elementary Differential Equations
5	PHYS 214	Engineering Physics II
3	CHM 531	Organic Chemistry I
CHE 416		Computational Techniques in Chemical Engineering
2	CHE 350	Electronic Materials
	or	
	CHE 352	Structural Materials
0	CHE 015	Engineering Assembly

Third Year (31)

Fall Semester (16)

2	CHE 520	Chemical Engineering Thermodynamics I
3	CHE 530	Transport Phenomena 1
3		Humanities/Social Science Elective
3	ENGL 415	Written Communication for Engineers
3		Chemistry/Biochemistry Elective
2		Advanced Laboratory Experience
0	CHE 015	Engineering Assembly

Spring Semester (15)

3	CHM 595	Physical Chemistry II
3	CHE 521	Chemical Engineering Thermodynamics II
3	CHE 531	Transport Phenomena II
3	CHE 535	Transport Phenomena Lab
3		Technical Elective
0	CHE 015	Engineering Assembly

Fourth Year (33)

Fall Semester (17)

3	CHE 550	Chemical Reaction Engineering
3	CHE 560	Separational Process Design
2	CHE 570	Chemical Engineering Systems Design I
6		Elective
3		Technical Elective
0	CHE 015	Engineering Assembly

Spring Semester (16)

3	CHE 542	Unit Operations Laboratory
3	CHE 561	Chemical Process Dynamics and Control
4	CHE 571	Chemical Engineering Systems Design II
3		Technical Elective
3		Chemical Engineering Elective
0	CHE 015	Engineering Assembly

Undergraduate Degree Planning Guide

This page has been provide to help undergraduate students plan their degree. The courses that are required for graduation are listed below with a space provided for what term the course shall be taken. The courses are group by area of discipline.

Math
MATH 220 _____
MATH 221 _____
MATH 222 _____
MATH 240 _____

DEN 015 _____
ECON 110 _____
SPCH 105 _____

Advanced Laboratory Experience
_____ _____

Technical Elective
_____ _____
_____ _____
_____ _____

Chemistry
CHM 210 _____
CHM 230 _____
CHM 371 _____
CHM 531 _____
CHM 595 _____

Chemistry/ Biochemistry Elective
_____ _____

Humanities/ Social Sciences Elective
_____ _____
_____ _____
_____ _____

Physics
PHYS 213 _____
PHYS 214 _____

English
ENGL 100 _____

Chemical Engineering Elective
_____ _____

Elective
_____ _____

Chemical Engineering
CHE 015 _____
CHE 110 _____
CHE 320 _____
CHE 350 _____
CHE 352 _____
CHE 416 _____
ENGL 415 _____
CHE 520 _____
CHE 521 _____
CHE 530 _____
CHE 531 _____
CHE 535 _____
CHE 542 _____
CHE 550 _____
CHE 560 _____
CHE 561 _____
CHE 570 _____
CHE 571 _____

Semester Hour Totals

e.g.	***Fall 2007***	***15***
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

Elective Selection Worksheet

Listed below are elective courses in four different areas that must be taken to satisfy the chemical engineering curriculum, with the total number of required credits in each area. You should circle the courses you plan to take and list on the lines below when you plan to take them.

Chemical Engineering (3 cr.)
CHE 350, 352, 497, 626, 661,
681, 682, 715, 735

_____

Chemistry/Biochemistry Biology (3 cr.)
CHM 532, 550, 566, 585, 586, 596
BIOCH 521, 522, 755, 756, 765
BIOL 765, 340

_____

Engineering (3 cr.)
CE 333, 530, DEN 300, 398,
EECE 510, 519, 525, 696
IMSE 530, ME 512

_____

Advance Laboratory Experience (2 cr.)
CHM 532, 596, BIOCH 522, 756
BIOL 541

_____

Possible Areas of Emphasis

In order to assist you in selecting electives tailored to your particular interests, seven possible areas of emphasis and some appropriate course work appropriate to each area. You may use one of these as a guide in developing your program of study or design one of suitable to your interests.

Bioengineering
CHE 350, 352, 626, 715,
BIOCH 755, 756, BIOL 198
EECE 510, CE 530,

Micro-Electronics Materials
CHE 497, 661, 681, CHM 585, 586,
EECE 510, 525, 696, PHYS 325

Chemical Industry
CHE 497, 682, 735, CHM 550,
532, 566, STAT 490, 491, 704
EECE 510, CE 530

Food
CHE 497, 715, BIOCH 521, 522
GRSC 602, 635, 636,
EECE 510, CE 530

General
Any CHE class not listed separately
in this curriculum, CHM 550, 585
BIOCH 521, EECE 510, EECE 519
CE 333, ME 512, CE 530

Leadership
Any CHE class not listed
separately in this curriculum
CHM 532, 550, 585, 586,
BIOCH 521, 522, AMETH 160,
LAR 322, PHILO 365, 390,
PSYCH 425, 560, 625,
EECE 510, CE 530, DEN 300,
398, IMSE 530

Pre-Med
CHE 626, 715, BIOCH 521, 522,
755, 756, 765, BIOL 108, 340,
EECE 510, CE 530

Student's educational objective:

Courses to satisfy the objective:

Part III: Opportunities for Undergraduates

Professional Experience

- Cooperative Education
- Industrial Internships
- Summer Employment

Enhance your engineering education at KSU by gaining valuable industrial and employment experience, while earning a substantial salary.

What is a professional experience?

Professional experiences include cooperative (co-op) education programs, industrial internships, and summer employment in an engineering/industrial setting.

The engineering co-op program is a joint work/academic program sponsored by Kansas State University and industry, where students alternate between work assignments in industry and academic study on campus.

K-State initiated its co-op program in 1963 as a means of providing engineering students a base of practical knowledge and experience beyond the academic environment, and to help them finance their educations.

Industrial internships and summer employment opportunities are not as formalized as a co-op experience and vary depending upon the industries' expectations.

How does one apply for a professional experience?

The student registers with Career Center in Berney Family Welcome Center (http://www.k-state.edu/careercenter/) He or she attends workshops conducted by Career Center staff to improve job search skills. Students may interview on campus, review Jobs On-Line listings for employment, or find their own position.

After accepting a co-op offer, a student will attend an orientation workshop or schedule an appointment to learn about the documentation process. Students must complete the freshman year before beginning a co-op work term. Employers vary in the amount of course work required before beginning a co-op work term. Those involved in the co-op program must be making regular progress toward graduation and maintaining a 2.50 grade point average. A co-op student may work from three to nine months, then return to K-State to take classes. This pattern may be repeated throughout the student's academic career.

Other forms of professional experiences may include only a summer, or a combination of a summer and academic semester in industry.

Why participate in a professional experience?

Students realize the following benefits from a professional experience:

- Receive the opportunity to confirm choice of major.
- Gain professional work experience prior to graduation and thereby enhance marketability.
- Increase understanding of classroom theory.
- Earn money to help pay college expenses.
- Gain useful employment contacts and enhance permanent employment opportunities.
- Develop confidence and professional skills.
- Return to the academic setting motivated to finish degree work.
- Achieve a competitive advantage over fellow students who do not have engineering work experience.

For more information, contact:

Experiential Learning Program
Career Center
Kansas State University
148 Berney Family Welcome Center
Manhattan, KS 66506-3412
785-532-6506
www.ksu.edu/careercenter/

Office of Recruitment and Leadership Development
1041 Engineering Hall
Manhattan, KS 66506
785-532-5455
Fax: 785-532-7810
kstateengg@k-state.edu
http://www.engg.ksu.edu/future-students/

Office of Student Services
1093 Fiedler Hall
Manhattan, KS 66506
785-532-5592
Fax: 785-532-7810
enggss@k-state.edu
http://www.engg.ksu.edu//studentservices/

International Programs

With the impact of new technologies and global communications on world markets, students are encouraged to gain valuable international experiences by participating in international internships, exchange programs, study abroad, and student societies that emphasize international activities such as the engineering student society, Mentors for International Experiences (MIE). The members of MIE provide assistance to local engineering students to enhance their opportunities and experience abroad. The organization also assists engineering students who are visiting and studying at Kansas State University.

Honors Program

The honors program in the College of Engineering offers all interested students an intellectual challenge consistent with their ability and interests. Entering engineering students with high school averages or entrance examination scores within the top five percent are encouraged to join the program. Transfer students with superior academic records are also eligible and will be invited to join the honors program. Sophomores and juniors enrolled in engineering who are qualified for the honors program may, with the endorsement of a member of the engineering faculty and the approval of the honors program director, join the program.

Because all credits obtained in the honors program are applicable to degree requirements, participation in the honors program will not alter the time required for graduation for most students and should be a stimulating experience. In addition to enrolling in honors sections in many courses, honors students may enroll in a variety of seminars, colloquia and independent study problems designed to enrich and challenge each participant. The engineering honors program is closely integrated with the honors program of the other colleges at KSU and provides participation in special enrichment activities. Students in the honors program may elect to withdraw from the program at any time.

The college has approved the development of individual programs for students participating in the honors program. Such programs will be developed between the student and a faculty adviser. Engineering advisers are encouraged to seek out students qualifying for the honors program, learn of their academic potential and their special interests, and help them develop programs of study that will meet their academic and professional interests. The academic programs developed must be approved by the student's adviser and department head.

Entering freshmen with a composite ACT score of at least 29 or who are in the upper 5 percent of their high school graduating class will be invited to join. Transfer students with a cumulative GPA of 3.50 or greater in at least 12 semester hours and students with a KSU cumulative GPA of 3.50 or greater in at least 12 hours are also eligible. For a student to remain in the honors program, a minimum 3.50 composite GPA must be maintained. The student may be on probation from the honors program for one semester if the GPA falls below 3.50. A student may be reinstated to the program if the composite GPA is raised to 3.50 or above that semester. Students previously in the honors program but dropped because of a low GPA may be reinstated on petition from an engineering faculty member and with the approval of the director of the

engineering honors program.

Diplomas and transcripts of students completing the engineering honors program will be inscribed "Honors Program." To complete the honors program, the students must qualify for an engineering degree with a composite GPA of at least 3.50 and must complete at least 4 semester hours of engineering honors courses including a minimum of two honors research hours.

Undergraduate Research Program and Independent Study

Students may participate in a special undergraduate research program or may pursue independent study through CHE 497. These opportunities may be particularly valuable for students planning to obtain an advanced degree or for students desiring work in a specific industry.

Students considering future research studies (such as graduate school) and employment (in an industrial or academic research environment) may participate in a special undergraduate research program by registering for CHE 497. At least 3 credits/semester are required, and students are strongly encouraged to participate for 2 semesters. These credits can be applied to the degree program as professional and engineering (technical) electives (6 credits maximum). Students will participate in special meetings covering topics such as: the methodology of conducting scientific research, the status of the research in industry and academia, ethics and scientific professionalism, safety, general opportunities for graduate research in chemical engineering, application procedures for graduate school, availability of national fellowships, and specific research opportunities at Kansas State. A faculty coordinator will arrange these general meetings. Students will select research projects (see below) by consultation with faculty members (collaborative projects are encouraged) and will attend group meetings on a regular basis. Students will be encouraged to attend the graduate research seminar (CHE 875) also. Upon completion of the research project, a written report will be submitted to the faculty coordinator. A poster display and presentation will be scheduled, and the superior achievement in CHE 497 will be determined by a panel of faculty and students. Outstanding performance in CHE 497 will also be recognized by participation in regional student chapter meetings and other events.

Students may also participate in a special topics project involving independent study by registering for CHE 497. These projects may include literature studies/reviews, completion of the AIChE Student Design Contest Problem, setting up a laboratory experiment, etc. Students may receive a maximum of 3 credits which can be applied to the professional and engineering (technical) electives requirement. Students will select these projects by consultation with individual faculty members. A written report will be required at the conclusion of the project, and an oral presentation is also expected. Participation in regional student chapter meetings is also anticipated for outstanding contributions.

Honors program students may participate in either option by registering for CHE 499.

More information about participation in CHE 499 can be obtained by contacting Professor Mary Rezac, Room 1017 Rathbone Hall, who serves as the faculty coordinator for the

Undergraduate Research Program.

Faculty and Their Research Interests

Students should contact faculty members directly if they are interested in working for them.

Placidus Amama *(Ph.D. Yokohama National University, 2002)*
- Heterogeneous catalysis, rational catalyst design, controlled synthesis of nanomaterials, nano-engineering of nanocarbon materials, energy storage, environmental remediation

Jennifer Anthony *(PhD. University of Notre Dame, 2004)*
- Advanced materials, molecular sieves, environmental applications, ionic liquids

James H. Edgar *(Ph.D. University of Florida, 1987)*
- Synthesis, process modeling, and materials characterization of wide energy band gap semiconductors.
- Bulk crystal growth of aluminum nitride.

Larry E. Erickson *(Ph.D. Kansas State University, 1964)*
- Director of the Great Plains/Rocky Mountain Hazardous Substance Research Center.
- Bioremediation, environmental engineering, bio-chemical engineering, and food engineering.

Ryan R. Hansen (*Ph.D. University of Colorado (Boulder), 2008*)
- High-content cell screening platforms
- Bacterial growth, interactions, and biofilm formation
- Polymeric materials for biosensing applications
- Biocompatible micro- and nano-patterning techniques
- Directed material assembly using micro/nano-scale chemical patterns

Keith L. Hohn *(Ph.D. University of Minnesota, 1999)*
- Research focus is on investigation of catalysts and reactor designs to convert light hydrocarbons to more valuable products. Developing new ways to utilize the world's vast reserves of natural gas is of particular interest. A significant focus is using short contact time reactors to convert light hydrocarbons to useful products. These reactors offer the possibility of high selectivity to the desired product at residence times of only milliseconds without the addition of external heat.

Bin Liu *(PhD. Colorado School of Mines, 2008)*
- First-principles density functional theory (DFT) has been rapidly adopted to determine the surfaces and interfaces properties of a broad range of catalyst materials. These ab initio calculations are capable of determining structural and energetic properties that are difficult, if not impossible, to access experimentally, and in some cases, the calculations have been used to identify new materials with superior properties.

Peter H. Pfromm (*Ph.D., University of Texas at Austin, 1994*)

- Membrane separations
- Nano-scale glassy polymer films
- Separations in bio-processing
- Electro-membrane processes
- Electrochemical processing

Mary E. Rezac (*Ph.D. University of Texas at Austin, 1993*)

- Design synthesis and application of polymers for membrane applications.
- Membrane - reactor design, modeling and application for green systems engineering.

John R. Schlup *(Ph.D. California Institute of Technology, 1981)*

- Sol-gel processing of ceramics, intelligent processing of materials, and new material from agricultural resources.
- Techniques to better characterize the mesoscale structure of sol-gels to provide improved control over the structure of the gels.
- The utility of near-infrared spectroscopy as a real-time sensor for food, polymer, and composite processing has been demonstrated utilizing fuzzy logic and neural network technologies.
- Polymer matrix composites employing leather and other biomass.

Aravind Suresh (*Ph.D. University of Connecticut, 2011*)

- Catalytic activity in electrically conductive ceramic oxides
- Initiated and photoinitiated chemical vapor deposition (iCVD and piCVD)
- Incorporating research into undergraduate chemical engineering laboratory courses

American Institute of Chemical Engineers (AIChE)

The professional society for chemical engineering is the American Institute of Chemical Engineers (AIChE). Kansas State University has a very active student chapter, which has gained national recognition through recent awards for its program and leadership and through awards won in student paper contests at regional meetings. More than one third of the undergraduates in chemical engineering are members of the student chapter.

The Kansas State University Chapter of the American Institute of Chemical Engineers (AIChE) seeks to connect our members with all aspects of the world around them. We are strongly linked to national AIChE, which allows us to interact with other chemical engineering students and chemical engineering professionals and executives around the nation during national and regional conferences. Our members show their dedication to the community through activities designed to provide the basic necessities of life to those in need in the surrounding community. KSU AIChE members participate in various college-wide events that celebrate all engineering disciplines, raise funds for scholarships, and promote the chemical engineering to prospective students. On the most fundamental level, AIChE provides an opportunity for chemical engineering students to interact outside of the classroom. The KSU AIChE chapter sponsors

multiple social events throughout the course of the school year to promote departmental unity.

The best time to sign up for membership will be at the fall picnic. Membership dues are $10 per year. If you have any questions about the student chapter, feel free to contact any of the officers listed below. We are looking forward to seeing you at the meetings.

Officers

President	Brett Bandy	**ChUMs Chair**	Devon Ronsse
Vice President	Rachel Walker	**Community Service Chair**	Brent Keffer
Secretary	Kendall Konrade	**Webmaster**	Joe Hewitt
Treasurer	Chris Burley	**Sophomore Chair**	Katharine Kellogg
Reactions Editor	Bayley Reiswig	**ESC Representative**	Justin Patrick
Open House	Priyasha Fernando Angelica White David Kourchenko	**Social Chair**	Megan Kohman Regan Wilson

Omega Chi Epsilon

Omega Chi Epsilon, Chemical Engineering Honor Society, recognizes and promotes high scholarship, original investigation and professional service in chemical engineering. The honor society was formed at the University of Illinois in 1931. Today there are thirty-five chapters at colleges and universities in the United States.

To be considered for membership, juniors must rank in the upper 20% of their class and seniors in the upper 30%. They must also have completed six hours of chemical engineering courses. In addition, members must possess those traits of personality and leadership which make them most likely to succeed in their chosen fields. Initiation ceremonies are held during fall semester.

For further information, please contact Dr. Jennifer Anthony, Room 1018 Durland Hall.

President	Diane Collard	**Secretary**	Natalie Davis
Vice President	Martha Floy	**Treasurer**	Elena Davidson
Social Chair	Riley Hay		

Other Honor Societies

There are a number of other honor societies available to chemical engineering students in addition to Omega Chi Epsilon. Some of them are listed below. Unless otherwise stated, membership is university-wide and available to undergraduates.

Society	Restrictions	Qualities Recognized
Alpha Lambda Delta	Freshmen	Scholarship
Cardinal Key	Seniors	Leadership, service, scholarship
Knights of St. Patrick	Engineering College	Leadership, service, character
Mortar Board	Juniors	Scholarship, leadership, service
Phi Eta Sigma	Freshmen	Scholarship
Phi Kappa Phi	All-University	Scholarship
Phi Lambda Upsilon	Chemistry/related fields	Scholarship
Tau Beta Pi	Engineering College	Scholarship, character

Employment & Scholarship Opportunities

To ensure being considered for a scholarship from the College of Engineering, please complete the following steps.

High School Seniors

- Submit the general scholarship application directly to the Office of Student Financial Assistance (OSFA). Please use the on-line form at http://www.k-state.edu/sfa/. This should be done by November 1.
- Send a copy of your transcript and a list of your senior classes directly to the scholarship coordinator in the College of Engineering. Either fax (785-532-7810) or submit by mail (1046 Rathbone Hall, KSU, Manhattan, KS 66506-5104). This should be done when you submit the scholarship application to the OSFA.
- Apply to K-State for admission at http://www.k-state.edu/undergradadmit/. Be sure to indicate engineering as your major. This will assure that you will be on all engineering lists and receive all engineering mailings.

Transfer Students

- Submit the general scholarship application directly to the Office of Student Financial Assistance (OSFA). Please use the on-line form at http://www.k-state.edu/sfa/. This

should be done by February 1.

- Send a copy of your transcript and a list of your senior classes directly to the scholarship coordinator in the College of Engineering. Either fax (785-532-7810) or submit by mail (1046 Rathbone Hall, KSU, Manhattan, KS 66506-5104). This should be done when you submit the scholarship application to the OSFA.
- Apply to K-State for admission at http://www.k-state.edu/undergradadmit/. Be sure to indicate engineering as your major. This will assure that you will be on all engineering lists and receive all engineering mailings.

When your transcript is received by the scholarship coordinator, she will check the university database to see if you have submitted the scholarship application with all of the necessary information, and are, in f act, admitted into engineering. You will receive a post card from the Scholarship Coordinator in the College of Engineering indicating the status of your application. After the Office of Student Financial Assistance has made its awards in early December, the College of Engineering will review those awards and follow with its own awards.

The scholarship application and transcripts are reviewed for many things. For incoming freshmen we consider ACT scores – both math and composite, cumulative GPA, rank in class, grade trends, courses taken, activities and honors. For transfer students, we consider cumulative GPA and total credit hours, along with courses taken and activities.

If you are awarded a College of Engineering scholarship, the award letter will show the amount of your scholarship and include an acceptance form for you to complete. Although you may not be sure that K-State or the College of Engineering is for your, accepting the engineering scholarship questions directly to Pat Nelson, project coordinator. The direct number is 785-532-6686, panelson@ksu.edu.

Continuing Students

- Students continuing their studies in the College of Engineering must apply each year for scholarships. Please do so by using the on-line form at http://www.k-state.edu/sfa/. This should be done by February 1.

Loans

Students interested in obtaining an education loan should contact the Office of Student Financial Assistance (OSFA).

Visitors welcome, M - F, 8:30 am to 4:45 pm

Phone: M - F, 8 a.m. - 5 p.m.
(877) 817-2287 (toll free)
(785) 532-6420

Fax: All day, every day
(785) 532-7628

Address: Office of Student Financial Assistance
104 Fairchild Hall

Manhattan, KS 66506-1104

E-mail: finaid@k-state.edu

http://www.k-state.edu/sfa/

Information about the requirements and arrangements for taking out a loan are best handled directly with personnel from the above office. After such a contact, if you still have questions, discuss it with your advisor.

Part-Time Employment
In addition to jobs available to students throughout the university, there are a number of part-time jobs available in the Chemical Engineering Department.

Research Helpers
The Chemical Engineering faculty employs undergraduate research helpers during the summer, fall, and spring for projects. Normally these positions require a person with at least sophomore standing. The work is widely varied since the primary function of the research helper is assisting graduate students with their projects. Typical functions include performing chemical analysis, constructing equipment, taking data, and data reduction. Through this type of work the student has an opportunity to gain valuable professional experience using modern equipment and research techniques.

Interested students should apply during the first two days of the semester in 1005 Durland.

Internships
During the freshman and sophomore years, intern opportunities in industry are limited. The best employment opportunity for students is normally in their local community. After the sophomore year industrial internships become available. Information is posted in the Career and Employment Services, 100 Holtz Hall. In the few cases where the Chemical Engineering Department is contacted directly, the information is posted on the internship bulletin board in Durland Hall. The Fall and Spring Career Fairs are excellent opportunities to pursue job opportunities.

Interviewing for summer opportunities usually starts early in fall semester and is essentially completed by the middle of the spring semester. Many students will obtain a satisfactory job by interviewing the company representatives coming to the campus.

An industrial internship is an excellent opportunity for students to observe first-hand the type of positions held by chemical engineers. Some students return to their summer employer for permanent employment. It must be understood however, that neither the employer nor employee is under any obligation to extend the summer internship to permanent employment.

There are many opportunities for summer work with various governmental agencies, both state and federal. Career and Employment Services, located in 100 Holtz Hall maintains an up-to-date file of opportunities for this type of work. Many of these agencies do not recruit on the

campus. The Career Center website is: http://www.k-state.edu/careercenter/.

The experience gained in the application of the principles studied in the classroom is noticeable to the student, and will make subsequent course work more meaningful.

Part IV: Preparing for the Future

Permanent Employment

By your last year you should have some career objective in mind. Study the list of interviewers that will be provided to seniors by Career Center (http://www.k-state.edu/careercenter/) when school begins in the fall. Select from it those companies that you feel most closely meet your career objectives. Your next step is to learn as much about these companies as you can.

Do not overlook state and federal agencies when seeking permanent employment. The various pollution control and environmental protection agencies offer unique opportunities for chemical engineering graduates.

Early in the fall semester, Career and Employment Services offers seminars on the interviewing process. Take full advantage of the services offered by this office; they are experts in the placement process. Students need to complete a copy of a personnel data sheet and submit it to the placement office in order to gain access to the services. Feel free to discuss with them interviewing problems that you may encounter. Get all the help you can in selling yourself to the interviewer. Start interviewing as soon as possible in the fall. You will gain confidence with experience.

Insofar as possible, arrange interview trips to miss as few classes as possible. Of course, you are expected to inform your instructors of travel plans before you leave and to make up all assignments. Many of your interviews can be scheduled between semesters.

When you seek employment it is common practice for prospective employers to ask you for faculty references. It is expected that you will contact the faculty member before you give his or her name as a reference. Take along a copy of your resume. Make sure that the references you choose know something about you. Questions typically found on reference requests include the following:

- Does the student finish assignments on time?
- Do the assignments show evidence of extra thought or effort?
- How does the student react to criticism?
- What are the students' attitudes towards safety practices?

Graduate Study in Chemical Engineering

Chemical Engineering students frequently discover that there is much to be learned about chemical engineering beyond what is taught in the undergraduate courses. Part of the purpose of graduate study (M.S. and Ph.D.) is to further develop the fundamental theories presented at the undergraduate level; many KSU students pursue graduate work for this reason.

An equally important purpose is to give the student an opportunity to plan, undertake, analyze and report on an independent research project. Graduate study may also qualify the student for employment opportunities which require more technical knowledge and research experience than has been acquired at the undergraduate level.

A very comprehensive resource for students thinking about going to graduate school is available at www.gradschools.com. This website has information about various schools and about the Graduate Record Examination (GRE) test along with other valuable information.

Students thinking about pursuing graduate studies should try to become involved in undergraduate research. At KSU, they can register for research credits through CHE 490, CHE 499 and up to 6 credits can be used towards their professional or ChE elective requirements. Summer research opportunities are also available at KSU. Students interested in pursuing summer research opportunities at other schools should visit http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517&from=fund for a list of the National Science Foundation Research Experience for Undergraduates sites.

Research and teaching assistantships or fellowships are widely available to qualified students for graduate study in chemical engineering. Typical stipends at KSU provide more than $20,500 per year in addition to tuition reductions. There are also several competitive fellowships such as the National Science Foundation, the Tau Beta Pi, and other graduate fellowships that students can apply for.

Application forms for admission to graduate study at Kansas State are available from Karen Strathman, Graduate Program Secretary, in 1005 Durland Hall. The application deadlines are Jan. 1 for the fall semester and August 1 for the spring semester. A list of current research areas of the Chemical Engineering faculty at Kansas State is also available on the Chemical Engineering website at: http://www.che.ksu.edu/research/

Preparation for Non-Engineering Graduate Study

Chemical engineering graduates are looked upon very favorably by medical, law, and business schools. Some planning is required to insure that you have taken the courses required by admissions committees for those programs. In addition to reading the information given below, students interested in law or medicine should visit with advisors in the Academic Assistance Center, 101 Holton Hall; and students interested in MBA study in business should visit with the College of Business Administration Graduate Program in Business Building.

Medical School
General requirements (in addition to the normal Chemical Engineering requirements)

BIOCH 521 (3) General Biochemistry
BIOCH 522 (2) General Biochemistry Laboratory
BIOCH 755 (3) Biochemistry I
BIOCH 756 (2) Biochemistry I Laboratory
BIOCH 765 (3) Biochemistry II
BIOL 198 (3) Principles of Biology
BIOL 340 (3) Structure and Function of the Human Body
EECE 510 (3) Circuit Theory I
CE 530 Statics and Dynamics

Some of these courses may be used to satisfy the professional elective requirements.

Business School (MBA)
Most MBA programs are set up to take students coming from non-business programs and have no specific requirements. However, such courses as ECON 110 and 120, which fulfill Humanities/Social Science elective requirements and a course in statistics, which may count as a Professional Elective, are highly recommended. Courses in accounting, management, or finance would provide a head start and can be taken as extra electives which would not count towards a Chemical Engineering degree.

Law School
Law schools generally have no specific course requirements but do look for courses where the student would have had writing and speaking experience, particularly where the topic required critical appraisal of material. Such courses often may be used as Social Science/ Humanities electives. For example, students have found that PHILO 160, Introduction to Philosophy of Law is helpful in preparing for the Law School Admissions Test.