

# **Academic Advising Handbook**

**Department of Chemical & Petroleum Engineering**

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Fall 2017 Edition

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## GENERAL ADVISING TOPICS

Academic advising is an integral part of your development as a chemical or petroleum engineer. We feel that it is an important part of our responsibility to assist you in meeting your academic and professional goals. This advising manual provides much of the information that you will need to get the most out of your academic advising sessions. Please review it often as it provides answers to many of the questions typically asked by students.

### ***Advising Responsibilities***

**You are responsible for your course of study and the fulfillment of the graduation requirements.** Before you can enroll, the University requires you to acknowledge that you are responsible. The development of your academic Plan of Study is done under the guidance of advisors in partnership with you. For this to be successful, you should be open with your advisors about your capabilities, goals, and problems. Our department has an Academic Advisor, Samantha Raines, who will work with you to understand all of the degree requirements for your intended major. Ideally, you should meet with our Academic Advisor as you begin the major. She will help you plan your academic program to graduate in Chemical or Petroleum Engineering within the time frame that you select, and insure that you do not take unnecessary courses. Our Academic Advisor is a good resource for information about major requirements, KU requirements, and outside offices such as Study Abroad or Career Services. You may also meet with the Academic Advisor to declare an emphasis or for assistance with any forms you might need.

In addition, every student in Chemical and Petroleum Engineering is assigned a faculty advisor. The name of your faculty advisor can be found on the myKU portal. Information about each faculty member can be found on the Departmental website (<http://cpe.ku.edu/faculty>). Each advisor knows the curriculum and is familiar with the elective courses. Your faculty advisor is an excellent resource for discussing the content of your courses, possible internships, providing insight into opportunities for professional development, and answering questions specific to Engineering as a discipline. Your faculty advisor is available throughout the academic year and you are encouraged to use them as a resource. Our goal is for you to have the same faculty advisor throughout your study with us. In certain circumstances you may wish to change faculty advisors. This request can be made with the Academic Advisor. Occasionally, we will not be able to honor a specific request, but we try to accommodate all requests.

It is your responsibility to keep your Plan of Study up to date. You should work with your faculty advisor and the Academic Advisor to make sure you are on track for graduation according to your plan. Preparation of your Plan of Study is to be done for all classes. When you are unsure of what electives you might take in the future, you still must plan when you will take them. They can generically be shown as KU Core, Adv Science (Advanced Science Elective), or Engr (Engineering Elective). By so doing, you will have reserved a course slot in that future semester for an elective. Planning is intended to be a flexible guide to assist you in evaluating your progress toward graduation. However, each semester you should review your academic plan with your faculty advisor during your enrollment advising meeting.

### ***Advising Documentation***

The majority of the documentation related to advising will be digital and accessible through the myKU portal. When you meet with a faculty member or the Academic Advisor, they will document notes from the meeting in your advising portal. Your Degree Progress Report (DPR) can also be found in the myKU portal. It is your responsibility to check your DPR frequently for errors or problems. Your faculty advisor or the

Academic Advisor can help you if you notice errors in your DPR. An electronic copy of your Plan of Study is kept by the department. You should ask your faculty advisor or the Academic Advisor to give you a copy of the Plan of Study when it is created. You can use this copy to keep track of and evaluate “what if” scenarios for graduation. The record of courses should be kept current as you progress through the curriculum. While it should be consistent with the DPR, there may be differences due to your individualized course of study. Differences, however, should be reconciled prior to the Application for Degree is filed.

### ***Timing for Advising***

You must see your faculty advisor twice per year during the University advising periods. These two periods are usually in October and March. **Prior to enrollment advising**, you will be notified about how to schedule your appointment with your faculty advisor.

We require that you meet with your faculty advisor so that they can review your academic progress, discuss your performance during the current semester, plan future semesters, and assist in your selection for specific courses for the coming semester and, potentially, summer session. Advising appointments are generally 15-30 minutes in length so it is critical that you come to the appointment prepared. **Prior to your appointment**, you should use your personal Plan of Study to select the courses you need to take for the upcoming semester. You will need to arrive for your faculty advising appointment with a recent copy of your DPR and your completed Enrollment Advising Form (<http://cpe.ku.edu/advising>). Your advisor will make a record of your meeting in the myKU Portal for future reference. You will fine-tune your schedule with your faculty advisor. If you need assistance getting prepared for faculty advising, contact the Academic Advisor.

Once you and your faculty advisor have discussed your progress, reviewed your Plan of Study, and signed your enrollment form, you will turn in the form at the C&PE front desk (4132 Learned Hall). We will make a copy of the form for you, and give you a copy to use when enrolling online. The School of Engineering has imposed an ‘Advising Hold’ on your enrollment. You will not be able to enroll until this hold is released by the Academic Advisor. The Academic Advisor will release holds within one day after you return your form *during the faculty advising period*. Turning in a form outside of the advising period may result in delays in getting your hold removed. Once your hold is removed, you may sign on to the enrollment website and enroll. While you may enroll in any course you wish, subject to prerequisites, you should enroll in the courses agreed upon on your form. It is important to note the many C&PE courses are only offered one time a year and are prerequisites for future courses. Changes in enrollment could result in significant delays in graduation.

### ***Prerequisites***

The Chemical and Petroleum Engineering course sequences are tightly woven. **You are responsible for being aware of and adhering to all pre-requisites, which can be checked online via the KU Course Catalog** (<http://catalog.ku.edu>). Each course depends upon you learning the knowledge and skills in the prerequisite courses. Should you fall behind developing this foundation, we advise you stop and re-take the course. However, you must understand that this will likely result in an additional year of study. You may not take a chemical or petroleum engineering course without having successfully completed the prerequisite requirements.

### **Add/Drop Periods**

The University has set three different periods during the course of a semester for adding and dropping courses. These roughly correspond to one third of the semester each. You should look at the University Calendar (<http://registrar.ku.edu/calendar>) to find out the beginning/ending dates for each period in any given semester as well as the Registrar's website (<http://registrar.ku.edu/adddrop-class>) for any specific rules, restrictions, and implications for adding or dropping courses.

In many cases you may be able to drop or add a class without seeing your faculty advisor. However, we encourage you to speak with them prior to dropping so that you can review your Plan of Study and assess the impact of dropping the course on your progress to graduation. Please do not wait to the last minute of an Add/Drop Period to see your advisor as they may not be immediately available.

### **Maximum Enrollment**

You may not enroll in more than 19 credit hours during the fall or spring semester (9 credit hours during the summer session) except with approval of your faculty advisor and the Associate Dean.

### **'Sixty-Hour' Guideline**

The faculty have developed the Chemical & Petroleum Engineering curricula with the proviso that students following these are well-prepared in the prerequisites, do not have substantial commuting time (i.e., are resident in Lawrence), do not have part-time job and/or do not have substantial extracurricular responsibilities. For those who must or want to work at a part-time job, for those with extracurricular time responsibilities and/or for those with substantial commuting times, we recommend the following 60-hour guideline (with needed adjustments depending on some special situations noted below):

*The number of productive hours per week for a student is 60. Subtract from this the number of hours per week required for the job, extracurricular activity and/or commuting. Take the remainder and divide by 3.*

This gives the absolute **maximum** number of hours for enrollment. For example, if a student must work 20 hours per week, the **maximum** number of hours for enrollment should be  $(60-20)/3 = 13$  credit hours.

This formula **over-estimates**, however, the maximum number of hours when any of the following apply:

1. The foundation in the prerequisite material is weak, e.g. a D in an earlier class such as Mass Transfer when enrolling in Design I;
2. A substantial number of hours to enroll in are junior/senior level, e.g. Fall Junior Year with 8 hours of junior-level chemical engineering courses;
3. A large percentage of the hours to be enrolled in are engineering courses, e.g. Spring Junior Year with 10 hours of chemical engineering courses;
4. The number of contact hours is larger than the number of credit hours, e.g. C&PE 626 with 8.5 contact hours for 3 credit hours;
5. Commuting time to the part-time job is substantial, e.g. from Lawrence to Johnson County; or,
6. Preparation time for work is extraordinary, e.g. a part-time job where the dress code is not student casual.

With respect to items 1 through 3, students should consider using a divisor of 4 instead of 3. This is in recognition that the number of extra hours required outside of the classroom increases with weak preparation or higher-level courses. With respect to items 4 through 6, students should consider subtracting these extra hours from 60 as well as the number of hours required for work or outside activities.

With the recommended cap on the maximum hours, the Plan of Study will, in all likelihood, span five academic years rather than the normal four years. While some students may be able to handle more commitments than others, the faculty experience indicates that, for most students, ignoring this guideline will result in lower grades and a weaker foundation in the prerequisite material for subsequent courses. This may result in decreased opportunities upon graduation. As always, your faculty advisor or the Academic Advisor will assist in modifying your Plan of Study to meet your individual needs.

### ***Credit/No Credit Grading***

Credit/no credit grading is not allowed for courses required for your major. In Chemical Engineering courses used to fulfill Goals 2.1, 3H, 3S, 4.1, and 4.2 can be taken as credit/no credit. In Petroleum Engineering courses used to fulfill Goals 2.1, 2.2, 3H, 3S, 4.1, 4.2, and 5.1 can be taken as credit/no credit.

### ***Non-traditional Credit and Placement Exams***

KU accepts several kinds of non-traditional earned credit including Advanced Placement, International Baccalaureate, military courses, and the College Level Examination Program. Retroactive credit is also offered in foreign-language classes, and ACT/SAT scores may exempt you from certain requirements. Additional information can be on KU's Admissions website ( <http://www.admissions.ku.edu/earningcredit>). The classes you are placed into often depend upon your ACT score or previous college work. If you want to take a more advanced class you will often need to take a placement exam. More information about placement and exams can be found on KU's First Year Experience website (<http://firstyear.ku.edu/planning/placement>).

### ***C&PE Course Substitution Policies***

Substitutions for required courses are occasionally permitted by petition. The petition must provide justification for the substitution. Your faculty advisor, a Department committee, and the Associate Dean of the School of Engineering must approve your petition. You can find this form on the School of Engineering website (<http://enr.ku.edu/forms>). You should not assume approval until the petition has gone through the entire process. Petitions for substitutions should be made in the freshman-junior years where changes are still possible rather than in the senior year where it is more difficult to make adjustments.

### ***Academic Minors***

The School of Engineering does not have specific academic minors. However, students may earn minor degrees based on the requirements of a particular School (Business or the College of Liberal Arts and Sciences, for example.) Minors are intended to be in an area beyond your normal field of study. Chemical Engineering students will not be awarded a minor in chemistry because this is closely allied with chemical engineering and not viewed as an extension of the student's major field of study.

To obtain a minor, the student must typically take at least 18 credit hours, 12 of which must be 300 level courses or above. The student must have at least a 2.0 GPA in the minor. If the department or program in

the College of Liberal Arts and Sciences has additional requirements for their minor, you must meet those requirements, as well. Students should visit the relevant departmental website to learn about specific requirements. To declare your minor, contact the relevant department directly and the School of Engineering.

### ***Scholarships in Chemical and Petroleum Engineering***

Chemical and Petroleum Engineering scholarships are awarded to entering freshmen with outstanding academic records. The requirements for scholarship retention and the probation process can be found on the departmental website.

### ***Departmental Honors***

An undergraduate may receive departmental honors by completing the B.S. with the following:

- 1) An overall grade-point average of 3.5 in courses taken at KU
- 2) A grade-point average of 3.5 in KU engineering courses
- 3) Completing C&PE 661 Undergraduate Honors Research for a minimum of 3 credit hours with a grade of A or B.

Students with overall grade-point averages of 3.5 in courses taken at KU and 3.5 in KU engineering courses are allowed to enroll in C&PE 661 in the second semester of the junior year. Enrollment in C&PE 661 constitutes acceptance into the Departmental honors program. The Departmental honors designation appears in the commencement program and on the transcript.

### ***Professional Registration***

Registration is a process that ultimately identifies an individual as an engineer who has achieved professional excellence and is recognized among his/her peers. It is the legal certification of the ability to practice engineering in the public arena. Professional registration may be a requisite for such things as expert testimony, federal and state reporting, engineering design certification and professional consulting. Consequently, we encourage students to begin the process of seeking professional registration while completing your undergraduate degree.

Professional registration requires passing the Fundamentals of Engineering Examination, four years' experience as a practicing engineer and, subsequently, passing the Principles and Practice of Engineering Examination. Juniors are eligible to take the examination in the spring semester. Seniors may take it fall or spring. Students are encouraged to take the Fundamentals of Engineering Examination during their junior or senior year at KU while the material covered in the examination is still fresh. Students who are planning to take the Fundamentals of Engineering Examination should speak with their faculty advisor about engineering elective courses that may assist in preparation for the exam. More information about the examination can be found on the National Council of Examiners for Engineering and Surveying website (<https://ncees.org/>).

### ***Undergraduate Degrees Offered***

The Department has a Bachelor of Science degree in Chemical Engineering and a Bachelor of Science degree in Petroleum Engineering. Specific requirements for each degree are discussed in the rest of this handbook.

## CHEMICAL ENGINEERING PROGRAM

### ***Department Mission Statement***

The overall program mission for the B.S. degree in chemical or petroleum engineering is to provide a modern chemical or petroleum engineering education with proper balance between theory and practice. Graduates are prepared for professional practice in industry or government and for post-undergraduate training in chemical or petroleum engineering, medicine, etc. In addition to scientific and engineering training, students receive training in educational skills and in the humanities and social sciences.

### ***Program Statement***

The principal objective of our program is to prepare graduates for professional practice in industry or government, and for post-undergraduate training in chemical engineering, medicine, and other related disciplines.

### ***Program Outcomes (Goals)***

- Students must develop the ability to apply basic and engineering sciences to identify, formulate, and solve chemical engineering problems.
- Students must display an ability to integrate and apply knowledge to solve complex problems, including the design of experiments and processes, interpretation of data/results and modification of the design based upon interpretation of data/results.
- Students must be able to develop responsible solutions to the professional and ethical situations in which they may find themselves in practice.
- Students must be able to evaluate the potential risks, i.e. consequences and probabilities of engineering solutions which may affect society and the environment.
- Students must demonstrate proficiency in the use of computer software such as spreadsheets, mathematics packages, word processors, and graphics in solution of engineering problems.
- Students must develop effective oral, written, and interpersonal communication skills.
- Students must learn how to work and interact effectively in groups/teams which have diverse personalities, cultures, and backgrounds.
- Students must demonstrate the ability to learn independently and be introduced to the necessity for life-long learning.
- Students must demonstrate thorough grounding in chemistry and a working knowledge of advanced chemistry selected as appropriate to the goals of the program (AIChE Program Criteria).
- Students must demonstrate a working knowledge of chemical engineering principles including material and energy balances applied to chemical processes; thermodynamics of physical and chemical equilibria; heat, mass, and momentum transfer; chemical reaction engineering; continuous stage-wise operations; process dynamics and control; process design; safety and environmental aspects and appropriate modern experimental and computing techniques.

## CHEMICAL ENGINEERING CURRICULUM

### ***Requirements for the Bachelor of Science Degree***

The requirements for graduation are spelled out in the Undergraduate Catalog of the university. The Undergraduate Catalog is the official document of record and takes precedence over this handbook. The Department of Chemical and Petroleum Engineering imposes these additional requirements:

- A student must achieve a combined 2.0 GPA in C&PE 211 and C&PE 221 to progress to C&PE 511, C&PE 512, C&PE 521, C&PE 523, and C&PE 524.
- A student must attain a cumulative grade-point average of at least 2.0 in required C&PE courses taken at KU through the junior year before being admitted to senior-level courses.
- A student must attain a cumulative grade-point average of at least 2.0 in C&PE courses taken at KU for graduation with a B.S. degree in chemical engineering.

The School of Engineering imposes the following additional requirements.

- A student must attain a cumulative grade-point average of at least 2.0 in the courses applied toward the degree. A student must also have a KU cumulative grade-point average of 2.0 whether or not all courses are being applied to the degree.
- A student must attain a cumulative grade-point average of at least 2.0 in all courses taken in the school, including courses not applied toward a degree.
- A student entering with advanced standing must attain a cumulative grade-point average of at least 2.0 in the resident courses applied toward the degree and at least a 2.0 in all courses taken in the school.
- A student must take the last 30 hours of credit toward the degree at KU and be officially enrolled in the School of Engineering during this time.

### ***Courses of Study***

The Bachelor of Science in Chemical Engineering general curriculum is designed with flexibility in choosing advanced science and engineering electives. In addition to the general option in Chemical Engineering, students can select from five emphases: Biomedical, Environmental, Materials Science, Premedical, and Petroleum. Students completing an emphasis are required to satisfy all the requirements for the Bachelor of Science in Chemical Engineering. The emphases may have specific requirements for the engineering and advanced science electives. The coursework required for the Bachelor of Science in Chemical Engineering and the requirements for each emphasis can be found in the catalog and on the departmental website. The departmental has created a curriculum guide (<https://cpe.ku.edu/undergraduate-curriculum>) which provides a suggested plan of study to graduate with a Bachelor of Science degree in Chemical Engineering in four years. Although there is some flexibility when elective courses are taken, most C&PE courses are offered only in the semester indicated and are prerequisites for future courses. Changes in enrollment could result in significant delays in graduation.

The curricular requirements for the Bachelor of Science degree in Chemical Engineering can be broken down into the categories shown below:

- General Education – KU Core
- Math
- Chemistry

- Physics
- Advanced Science
- Chemical Engineering Courses
- Engineering Electives

The sections below describe the specific requirements in each of the categories for completion of the Bachelor of Science degree in Chemical Engineering.

### General Education - The KU Core

Students must complete all requirements in the KU Core to graduate. For an in depth guide to these requirements visit the KU Core website (<https://kucore.ku.edu/>). Many of the courses in your major count towards the KU Core and require you to complete no additional coursework. Others will be fulfilled by choosing coursework from the list of courses provided. Below is a table which shows how the KU Core requirements are satisfied by the Bachelor of Science degree in Chemical Engineering.

Goal	Outcome	Courses which Satisfy Requirement
1	1	PHSX 210, PHSX 211 or PHSX 213
	2	CHEM 130 or CHEM 170 or CHEM 190
2	1	ENGL 101, ENGL 102, or ENGL 105
	2	C&PE 613 and C&PE 616 and C&PE 626 (3 course sequence)
3	Humanities	KU Core G3H Elective
	Natural Science	CHEM 135 or CHEM 175 or CHEM 195
	Social Science	KU Core G3S Elective
4	1	KU Core AE 4.1 Elective
	2	KU Core AE 4.2 Elective
5	1	C&PE 522 and C&PE 624 (2 course sequence)
6	1	C&PE 613 or C&PE 623

Goal 2, Learning Outcome 1, of the KU Core requires six hours of university coursework during the first two years, at least three hours of which require inquiry-based writing. You must enroll in the appropriate English course in your first semester at KU and maintain continuous enrollment in appropriate English courses, whether these are Applied English Center courses or regular English courses, until you have completed the core requirement. If you are exempt from ENGL 101 this will satisfy the first of your Goal 2 Learning Outcome 1 courses without any actual credits received. You do not need to make up these credits for C&PE, but be aware that other majors may require you to take additional hours to make up this difference. You may not enroll in C&PE laboratory courses (C&PE 616 or C&PE 626) until you have completed your Goal 2 Learning Outcome 1 coursework.

If you are an international student, as soon as you are released by the AEC, you must enroll in ENGL 101. Credits for English Composition at a foreign institution are not accepted for the required English courses in any engineering curriculum.

Goal 3 of the KU core addresses humanities, natural sciences, and social sciences. You will satisfy your natural science requirement with your second semester of chemistry. You will choose an approved G3H and G3S course to complete those requirements.

Goal 4 of the KU Core addresses diversity and global awareness. You will choose an approved AE4.1 and AE4.2 elective to complete those requirements. If you satisfy Goal 4.2 with an experience or by nature of being an international student, you must take an additional MSEHS (math, science, engineering, humanities or social science) course to make up the 3 credits.

Without any exemptions or transferred credit, these general education requirements will total 18 hours. The list of courses that meet these requirements changes often. You can find the most current list of approved KU Core courses on the KU Core website (<https://kucore.ku.edu/fulfilling-core->) or by searching the KU Schedule of Classes (<https://Classes.ku.edu>) for a specific goal.

## **Mathematics**

A minimum of seventeen (17) hours of mathematics is required. The math classes that you need to complete are:

- MATH 125 – Calculus I (4 hrs)
- MATH 126 – Calculus II (4 hrs)
- MATH 127 – Calculus III (4 hrs)
- MATH 220 – Differential Equations (3 hrs)
- MATH 290 – Linear Algebra (2 hrs)

All requirements shown above can be satisfied by the honors equivalent of the course listed.

Transfer students may have fulfilled the course requirements but may be short on hours. In this case, an additional mathematics course must be taken. MATH 526, Probability and Statistics (3 credits) is often used for this purpose. MATH 465, Probability and Statistics for Engineers, is also recommended. Other mathematics courses numbered 500 and above are acceptable. Substitution of natural science courses to meet the minimum mathematics requirement is not permitted.

Students may qualify for retroactive credit in mathematics by completing the second course in a sequence with a grade of "C" or better. Students seeking information on retroactive credit should contact the Mathematics Department.

## **Chemistry**

A minimum of 19 hours of chemistry is required. The required chemistry courses are:

- CHEM 170 – Chemistry for Chemical Sciences I (5 hrs)
- CHEM 175 – Chemistry for Chemical Sciences II (5 hrs)
- CHEM 330 – Organic Chemistry I (3 hrs)
- CHEM 331 – Organic Chemistry I Laboratory (2 hrs)
- CHEM 525 – Physical Chemistry for Engineers (4 hrs)

All requirements shown above can be satisfied by the honors equivalent of the course listed. CHEM 130 and CHEM 135 are acceptable alternatives to CHEM 170 and CHEM 175. CHEM 150 is not an accepted for credit towards the Bachelor of Science degree in Chemical Engineering.

Transfer students may have fulfilled the course requirements but may be short on hours. In this case, an additional natural science or engineering elective hours may be used to make up the credit hours.

## Physics

A minimum of 8 hours of physics is required. The required physics courses are:

- PHSX 210 – General Physics I for Engineers (3 hrs)
- PHSX 216 – General Physics I Laboratory (1 hrs)
- PHSX 212 – General Physics II (3 hrs)
- PHSX 236 – General Physics II Laboratory (1 hrs)

All requirements shown above can be satisfied by the honors equivalent of the course listed. PHSX 211 is also an acceptable alternative to PHSX 210.

Transfer students may have fulfilled the course requirements but may be short on hours. In this case, an additional natural science or engineering elective hours may be used to make up the credit hours.

If you have taken a non-calculus based physics I course such as PHSX 114, you are exempt from PHSX 216. You may complete the physics requirements by enrolling in PHSX 201 for 1.0 credit hour or taking PHSX 210 for 3.0 hours. If you have taken a non-calculus based physics II course such as PHSX 115, you are exempt from PHSX 236. You may complete the physics requirements by enrolling in PHSX 202 for 1.0 credit hour or taking PHSX 212 for 3.0 hours.

## Advanced Science Electives

A minimum of 6 hours of advanced science electives are required. The intent of the advanced science elective is to provide students with training at an advanced level in the sciences fundamental to the discipline of chemical engineering. Advanced generally means a course requiring introductory science (chemistry or physics) as a prerequisite. Based on this guideline a list of courses approved to for use towards the advanced science requirement is shown below.

Course	Hours	Prerequisites
BIOL 150 (Intro to Biology)	4	CHEM 130/150/170 (co-req)
C&PE 327 (Reservoir Engineering I)**	1	CHEM 135/175
C&PE 657 (Polymers)**	3	Senior Standing in Chem E
C&PE 765/CE 715 (Corrosion Eng.)**	3	CHEM 135/150/175
CE 570/571 (Chem. Prin. of Env. Eng)**	2+1	CE 477 (which req CHEM 135/175)
CE 573 (Biol. Prin. Of Env. Eng)**	3	CE 477 (which req CHEM 135/175)
CHEM 335/336 (Organic II)	3+2	CHEM 330/331
CHEM 620/621 (Analytical)	3+2	CHEM 330/331
CHEM 660/661 (Inorganic)	3+2	CHEM 530 (Physical Chem I)
GEOL 101/103 (Intro to Geology)	3+2	None*
ME 306 (Science of Materials)**	3	CHEM 130/150/170
PHSX 313/316 (General Physics III)	3+1	PHSX 212, PHSX 236
PHSX 521 (Mechanics)	3	PHSX 211, PHSX 216
PHSX 531 (Elec. And Mag)	3	PHSX 212 and PHSX 236

\*Geology has no introductory course which requires chemistry or physics as a prerequisite. Geology 101 is the highest-level introductory course offered by the department.

\*\* Engineering courses listed may be used as either engineering electives or advanced science electives or the hours may be split between the two categories. It is not acceptable to use the same hours to satisfy both requirements.

Other courses could be accepted by petition, but only if those courses require chemistry or physics as a prerequisite. Research in engineering or another science department could be accepted by petition, with a written final report and a letter from the supervisor attesting to the advanced science content. All petitions will be evaluated by the Academic Standards Committee. Higher-level science courses (biology, chemistry, physics, and geology) that have an approved course listed as a prerequisite are acceptable and would not require a petition. Honors versions of any of the above courses would always be acceptable without a petition.

### **Chemical Engineering Courses**

The Bachelor of Science degree in Chemical Engineering requires 48 hours of coursework in the department. The specific courses required are:

- C&PE 111 - Introduction to the Chemical Engineering Profession (2 hrs)
- C&PE 211 - Material & Energy Balances (4 hrs)
- C&PE 221 - Chemical Engineering Thermodynamics (3 hrs)
- C&PE 325 - Numerical Methods and Statistics for Engineers (3 hrs)
- C&PE 511 - Momentum Transfer (3 hrs)
- C&PE 512 - Chemical Engineering Thermodynamics II (3 hrs)
- C&PE 521 - Heat Transfer (3 hrs)
- C&PE 522 - Economic Appraisal of Chemical and Petroleum Projects (2 hrs)
- C&PE 523 - Mass Transfer (4 hrs)
- C&PE 524 - Chemical Engineering Kinetics and Reactor Design (3 hrs)
- C&PE 613 - Chemical Engineering Design I (4 hrs)
- C&PE 615 - Introduction to Process Dynamics and Control (3 hrs)
- C&PE 616 - Chemical Engineering Laboratory I (3 hrs)
- C&PE 623 - Chemical Engineering Design II (2 hrs)
- C&PE 624 - Process Safety and Sustainability (3 hrs)
- C&PE 626 - Chemical Engineering Laboratory II (3 hrs)

If you are a transfer student, either from within KU, from another university, or from a community college, you are not required to take C&PE 111. Instead you must make up the 2 hours of C&PE 111 with 2 hours of engineering elective or 1 hour of engineering elective and 1 hour of math, science, engineering, humanities, or social science (MSEHS). In the case of a student transferring from another engineering department, you may transfer another introductory course for C&PE 111.

It is important to note that the C&PE courses are generally only offered 1 time per academic year and are prerequisites for subsequent courses. Failure to complete the courses during the scheduled semester will result in delaying graduation by at least 1 year. It is also important that you recognize that a thorough understanding

of the material in these courses is critical to your success in the chemical engineering profession. Earning a “D”, while a passing grade for the course, may indicate that you are not suitably prepared for subsequent courses. Historically, students that earn a “D” in C&PE 211 (Material & Energy Balances) and do not retake the course, have a small probability of graduating with a Bachelor of Science degree in Chemical Engineering. Therefore, the faculty strongly recommend you retake C&PE 211 if you earn a “D” and want to graduate in Chemical Engineering.

### **Engineering Electives**

Twelve hours of engineering electives are required for a Bachelor of Science degree in Chemical Engineering. At least 6 elective hours must be taken from engineering areas outside the department. A minimum 3 hours and a maximum of 6 hours must be taken within the Chemical and Petroleum Engineering department. The only exception to this is for the Environmental emphasis, in which all four electives are CE environmental courses. Some engineering courses duplicate material that you are required to take as part of your degree program and cannot be counted as engineering electives. In addition, introductory courses in all departments are not acceptable as engineering electives. A list of courses that cannot be used for engineering elective credit as well as those commonly selected can be found on the departmental website (<https://cpe.ku.edu/elective-information>).

Petroleum engineering course 200 level and above may be taken by students pursuing chemical engineering degrees as engineering electives, if the prerequisites are met. The six-hour maximum discussed above does not hold in this case—Petroleum Engineering classes can be counted as “inside” or “outside” C&PE for Chemical Engineering majors. In addition, some cross disciplinary courses may be counted as either inside or outside C&PE electives. These courses include: C&PE 601 (Nanotechnology), 655, 656, and 752. Other courses could be accepted by petition. All petitions will be evaluated by the Academic Standards Committee.

### **Emphasis Requirements**

Students completing the requirements described above will earn a Bachelor of Science in Chemical Engineering degree, also known as the general option. Within Chemical Engineering, students may also choose to complete an emphasis: Biomedical, Environmental, Materials Science, Premedical, and Petroleum. Students completing an emphasis are required to satisfy all the requirements for the Bachelor of Science degree in Chemical Engineering general option. In addition, each emphasis has specific requirements for some of the engineering and advanced science electives. The coursework required for each emphasis is described below.

### **Biomedical Emphasis**

The following advanced science and engineering elective courses must be completed as part of the 6 hours of advanced science and 12 hours of engineering electives required for the biomedical emphasis:

- BIOL 150 Principles of Molecular and Cellular Biology (4 hrs) Counts towards advance science elective
- BIOL 600 Intro to Biochemistry (3 hrs) Counts towards advance science elective
- or
- BIOL 546 Mammalian Physiology (3 hrs) Counts towards advance science elective
- C&PE 656 Intro to Biomedical Engineering (3 hrs) Counts towards engineering elective

## Environmental Emphasis

The following engineering elective courses must be completed as part of the 12 hours of engineering electives required for the environmental emphasis:

- CE 477 Introduction to Environmental Engineering and Sciences (3 hrs)
- CE 5XX/7XX Upper level Environmental Engineering Course (3 hrs)
- CE 5XX/7XX Upper level Environmental Engineering Course (3 hrs)
- CE 5XX/7XX Upper level Environmental Engineering Course (3 hrs)

## Material Science Emphasis

4 courses from the following list must be completed as part of the 12 hours of engineering electives required for the material science emphasis:

- ARCE 350 Building Materials Science (3 hrs)
- AE 507 Aerospace Structures (3 hrs)
- AE 510 Aerospace Materials and Processes (4 hrs)
- CE 310 Strength of Materials (4 hrs)
- CE 412 Structural Engineering Materials (3 hrs)
- CE 461 Structural Analysis (4 hrs)
- C&PE 655 Introduction to Semiconductor Processing (3 hrs)
- C&PE 657 Polymer Science and Technology (3 hrs)
- C&PE 751 Basic Rheology (3 hrs)
- C&PE 752 Tissue Engineering (3 hrs)
- C&PE 765 Corrosion Engineering (3 hrs)
- ME 306 Science of Materials (3 hrs)
- ME 311 Mechanics of Materials (3 hrs)
- ME 767 Molecular Biomimetics (3 hrs)
- CHEM 680, C&PE 715, BIOL 420, PHSX 600, EPHX 600 Introduction to nanotechnology (3 hrs)
- C&PE 651/661 Undergraduate Research (By petition)

In addition, it is recommended that students choose 1 of the following courses to satisfy part of the 6 hours of advanced science electives required for the material science emphasis:

- PHSX 313 Introduction to Modern Physics (3 hrs)
- BIOL 150 Principles of Molecular & Cellular Biology (4 hrs)
- CHEM 620 Analytical Chemistry (3 hrs)
- CHEM 621 Analytical Chemistry Laboratory (2 hrs)
- CHEM 635 Instrumental Methods of Analysis Laboratory (2 hrs)
- CHEM 636 Instrumental Methods of Analysis Laboratory (2 hrs)
- CHEM 660 Systematic Inorganic Chemistry (3 hrs)

## **Petroleum Emphasis**

The following advanced science and engineering elective courses must be completed as part of the 6 hours of advanced science and 13 hours of engineering electives required for the petroleum emphasis:

- GEOL 101 Introduction to Geology (3 hrs) Counts towards advanced science elective
- GEOL 103 Fundamentals of Geology Laboratory (2 hrs) Counts towards advanced science elective
- C&PE 327 Reservoir Engineering I (4 hrs) 1 hour counts towards advanced science elective, 3 hours counts towards engineering elective
- C&PE 527 Reservoir Engineering II (4 hrs) Counts towards engineering elective
- C&PE XXX Petroleum Engineering Elective (3 hrs) Counts towards engineering elective

## **Premedical Emphasis**

The following advanced science courses must be completed as part of the 6 hours of advanced science required for the premedical emphasis:

- BIOL 150 Principles of Molecular and Cellular Biology (4 hrs) Counts towards advance science elective
- BIOL 152 Organismal Biology (4 hrs) Counts towards advance science elective
- CHEM 335 Organic Chemistry II (3 hrs)
- BIOL 600 Intro to Biochemistry (3 hrs)

While these courses complete the requirements for the Bachelor of Science in Chemical Engineering with the premedical emphasis, there may be additional requirements for medical school admission or for successful completion of the MCAT. You should check with any medical school that you are considering to determine if they have additional requirements for admission. Some additional recommended courses are:

- PSYC 104 General Psychology (3 hrs) Counts towards KU Core Goal 3S
- SOC 104 Elements of Sociology (3 hrs) Counts towards KU Core Goal 3S or 4.1
- BIOL 350 Principles of Genetics (3 hrs)
- BIOL 416 Cell Structure and Function (3 hrs)
- BIOL 546 Mammalian Physiology (3 hrs)
- BIOL 547 Mammalian Physiology Laboratory (2 hrs)

## PETROLEUM ENGINEERING PROGRAM

### ***Department Mission Statement***

The overall program mission for the B.S. degree in chemical or petroleum engineering is to provide a modern chemical or petroleum engineering education with proper balance between theory and practice. Graduates are prepared for professional practice in industry or government and for post-undergraduate training in chemical or petroleum engineering, medicine, etc. In addition to scientific and engineering training, students receive training in educational skills and in the humanities and social sciences.

### ***Program Statement***

The principal objective of our program is to prepare graduates for professional practice in industry or government, and for post-undergraduate training in chemical engineering, medicine, and other related disciplines.

- Graduates must have demonstrated thorough grounding in geology including structural and sedimentary geology, chemistry, mathematics and physics; thorough grounding in the basic engineering sciences including statistics and dynamics, circuits, strength of materials, thermodynamics, material and energy balances, heat transfer, and fluid mechanics; working knowledge of reservoir engineering, production and well completion engineering, modern drilling practices, well logging, economic analysis, water flooding and reservoir simulation, and appropriate modern experimental and computing techniques.
- Graduates must be able to function on multi-disciplinary teams and communicate effectively through active listening and verbal, written, and graphic expression.
- Graduates must understand the importance of professional responsibility and high ethical standards; must have a knowledge of contemporary issues; must possess a broad education necessary to understand the impact of engineering solutions in a global/societal context; and must have a recognition of the need for and an ability to engage in life-long learning.

### ***Program Outcomes (Goals)***

- Students must develop the ability to apply basic and engineering sciences to identify, formulate, and solve petroleum engineering problems.
- Students must display an ability to integrate and apply knowledge to solve complex problems, including the design of experiments and processes, interpretation of data/results and modification of the design based upon interpretation of data/results.
- Students must be able to develop responsible solutions to the professional and ethical situations in which they may find themselves in practice.
- Students must be able to evaluate the potential risks, i.e. consequences and probabilities of engineering solutions which may affect society and the environment.
- Students must demonstrate proficiency in the use of computer software such as spreadsheets, mathematics packages, word processors, and graphics in solution of engineering problems.
- Students must develop effective oral, written, and interpersonal communication skills.

- Students must learn how to work and interact effectively in groups/teams which have diverse personalities, cultures, and backgrounds.
- Students must demonstrate the ability to learn independently and be introduced to the necessity for life-long learning.
- Students must demonstrate competency in mathematics through differential equations, probability, and statistics; fluid mechanics; strength of materials; and thermodynamics.
- Students must demonstrate competency in petroleum engineering including design and analysis of well systems, procedures for drilling and completing wells, characterization and evaluation of subsurface geological formations, design and analysis of systems for producing, injecting and handling fluids; application of reservoir engineering principles and practices for optimizing resource development and management; use of project economics and resource valuation methods for design and decision making under conditions of risk and uncertainty.

## **PETROLEUM ENGINEERING CURRICULUM**

### ***Requirements for the Bachelor of Science Degree***

The requirements for graduation are spelled out in the Undergraduate Catalog of the university. The Undergraduate Catalog is the official document of record and takes precedence over this handbook. The Department of Chemical and Petroleum Engineering imposes these additional requirements:

- A student must have an average GPA for the highest grade earned in ME 312 (or C&PE 221) and C&PE 327 of at least a 2.0 to be eligible for the junior year courses: C&PE 527 and 528.
- A student must attain a cumulative grade-point average of at least 2.0 in required C&PE courses taken at KU through the junior year before being admitted to senior-level courses.
- A student must attain a cumulative grade-point average of at least 2.0 in C&PE courses taken at KU for graduation with a B.S. degree in chemical or petroleum engineering.

The School of Engineering imposes the following additional requirements.

- A student must attain a cumulative grade-point average of at least 2.0 in the courses applied toward the degree. A student must also have a KU cumulative grade-point average of 2.0 whether or not all courses are being applied to the degree.
- A student must attain a cumulative grade-point average of at least 2.0 in all courses taken in the school, including courses not applied toward a degree.
- A student entering with advanced standing must attain a cumulative grade-point average of at least 2.0 in the resident courses applied toward the degree and at least a 2.0 in all courses taken in the school.
- A student must take the last 30 hours of credit toward the degree at KU and be officially enrolled in the School of Engineering during this time.

### ***Courses of Study***

The curriculum guide (<https://cpe.ku.edu/undergraduate-curriculum>) provides a suggested plan of study to graduate with a Bachelor of Science degree in Petroleum Engineering in four years. Although there is some flexibility when elective courses are taken, most C&PE courses are offered only in the semester indicated

and are prerequisites for future courses. Changes in enrollment could result in significant delays in graduation.

The curricular requirements for the Bachelor of Science degree in Petroleum Engineering can be broken down into categories shown below:

- General Education – KU Core
- Math
- Chemistry
- Physics
- Geology
- Science Electives
- Petroleum Engineering Courses
- Engineering Electives

The sections below describe the specific requirements in each of the categories for completion of the Bachelor of Science degree in Petroleum Engineering.

### General Education - The KU Core

Students must complete all requirements in the KU Core to graduate. For an in depth guide to these requirements visit the KU Core website (<https://kucore.ku.edu/>). Many of the courses in your major count towards the KU Core and require you to complete no additional coursework. Others will be fulfilled by choosing coursework from the list of courses provided. Below is a table which shows how the KU Core requirements are satisfied by the Bachelor of Science degree in Petroleum Engineering.

Goal	Outcome	Courses which Satisfy Requirement
1	1	PHSX 210, PHSX 211 or PHSX 213
	2	CHEM 130
2	1	ENGL 101, ENGL 102, or ENGL 105
	2	COMS 130
3	Humanities	ENGL 203 – Writing for Engineers
	Natural Science	CHEM 135
	Social Science	KU Core G3S Elective
4	1	KU Core AE 4.1 Elective
	2	KU Core AE 4.2 Elective
5	1	KU Core 5.1 Elective
6	1	C&PE 628

Goal 2, Learning Outcome 1, of the KU Core requires six hours of university coursework during the first two years, at least three hours of which require inquiry-based writing. You must enroll in the appropriate English course in your first semester at KU and maintain continuous enrollment in appropriate English courses, whether these are Applied English Center courses or regular English courses, until you have completed the core requirement. If you are exempt from ENGL 101 this will satisfy the first of your Goal 2 Learning Outcome 1 courses without any actual credits received. You do not need to make up these credits for C&PE, but be aware that other majors may require you to take additional hours to make up this difference. If you are an international student, as soon as you are released by the AEC, you must enroll in

ENGL 101. Credits for English Composition at a foreign institution are not accepted for the required English courses in any engineering curriculum.

Goal 2.2 of the KU Core addressed oral communications. You must take COMS 130 to satisfy the Goal 2.2 requirement of the KU Core.

Goal 3 of the KU Core addresses humanities, natural sciences, and social sciences. You will satisfy your natural science requirement with your second semester of chemistry. You will satisfy the Goal 3H requirement with ENGL 203 – Writing for Engineers. You will choose an approved G3S course to complete this requirement.

Goal 4 of the KU Core addresses diversity and global awareness. You will choose an approved AE4.1 and AE4.2 elective to complete those requirements. If you satisfy Goal 4.2 with an experience or by nature of being an international student, you must take an additional MSEHS (math, science, engineering, humanities or social science) course to make up the 3 credits.

Goal 5 of the KU Core addresses ethics. You will choose an approved elective from the Goal 5.1 list to satisfy this requirement.

Without any exemptions or transferred credit, these general education requirements will total 24 hours. The list of courses that meet these requirements changes often. You can find the most current list of approved KU Core courses on the KU Core website (<https://kucore.ku.edu/fulfilling-core->) or by searching the KU Schedule of Classes (<https://Classes.ku.edu>) for a specific goal.

## **Mathematics**

A minimum of seventeen (17) hours of mathematics is required. The math classes that you need to complete are:

- MATH 125 – Calculus I (4 hrs)
- MATH 126 – Calculus II (4 hrs)
- MATH 127 – Calculus III (4 hrs)
- MATH 220 – Differential Equations (3 hrs)
- MATH 290 – Linear Algebra (2 hrs)

All requirements shown above can be satisfied by the honors equivalent of the course listed.

Transfer students may have fulfilled the course requirements but may be short on hours. In this case, an additional mathematics course must be taken. MATH 526, Probability and Statistics (3 credits) is often used for this purpose. MATH 465, Probability and Statistics for Engineers, is also recommended. Other mathematics courses numbered 500 and above are acceptable. Substitution of natural science courses to meet the minimum mathematics requirement is not permitted.

Students may qualify for retroactive credit in mathematics by completing the second course in a sequence with a grade of "C" or better. Students seeking information on retroactive credit should contact the Mathematics Department.

## **Chemistry**

A minimum of 10 hours of chemistry is required. The required chemistry courses are:

- CHEM 130 – General Chemistry I (5 hrs)
- CHEM 135 – General Chemistry II (5 hrs)

All requirements shown above can be satisfied by the honors equivalent of the course listed CHEM 150 is not an accepted for credit towards the Bachelor of Science degree in Petroleum Engineering.

Transfer students may have fulfilled the course requirements but may be short on hours. In this case, an additional natural science or engineering elective hours may be used to make up the credit hours.

## **Physics**

A minimum of 8 hours of physics is required. The required physics courses are:

- PHSX 210 – General Physics I for Engineers (3 hrs)
- PHSX 216 – General Physics I Laboratory (1 hrs)
- PHSX 212 – General Physics II (3 hrs)
- PHSX 236 – General Physics II Laboratory (1 hrs)

All requirements shown above can be satisfied by the honors equivalent of the course listed. PHSX 211 is also an acceptable alternative to PHSX 210.

Transfer students may have fulfilled the course requirements but may be short on hours. In this case, an additional natural science or engineering elective hours may be used to make up the credit hours.

If you have taken a non-calculus based physics I course such as PHSX 114, you are exempt from PHSX 216. You may complete the physics requirements by enrolling in PHSX 201 for 1.0 credit hour or taking PHSX 210 for 3.0 hours. If you have taken a non-calculus based physics II course such as PHSX 115, you are exempt from PHSX 236. You may complete the physics requirements by enrolling in PHSX 202 for 1.0 credit hour or taking PHSX 212 for 3.0 hours.

## **Geology Electives**

A minimum of 13 hours of Geology is required. The required Geology courses are:

- GEOL 101 – Introduction to Geology (3 hrs)
- GEOL 103 – Fundamentals of Geology Laboratory (2 hrs)
- GEOL 591 – Geology for Petroleum Engineers (4 hrs)
- GEOL 535 – Petroleum & Subsurface Geology (4 hrs)

GEOL 331 is a suitable alternative to GEOL 591.

## Petroleum Engineering Courses

The Bachelor of Science degree in Petroleum Engineering requires 49 hours of coursework in the department. The specific courses required are:

- C&PE 117 – Energy in the Modern World (1 hrs)
- C&PE 127 - Introduction to the Petroleum Engineering Profession (1 hrs)
- C&PE 217 – Introduction to Petroleum, Drilling Engineering (2 hrs)
- C&PE 219 – Drilling Fluids Laboratory (1 hrs)
- ME 312 or C&PE 221 – Basic Engineering Thermodynamics (3 hrs)
- C&PE 325 - Numerical Methods and Statistics for Engineers (3 hrs)
- C&PE 327 – Reservoir Engineering I (4 hrs)
- C&PE 511 - Momentum Transfer (3 hrs)
- C&PE 521 - Heat Transfer (3 hrs)
- C&PE 522 - Economic Appraisal of Chemical and Petroleum Projects (2 hrs)
- C&PE 527 – Reservoir Engineering II (4 hrs)
- C&PE 528 – Well Logging (3 hrs)
- C&PE 617 – Drilling & Well Completion (3 hrs)
- C&PE 618 – Secondary Recovery (4 hrs)
- C&PE 619 – Petroleum Engineering Laboratory I (3 hrs)
- C&PE 625 – Unconventional Recovery (3 hrs)
- C&PE 627 – Petroleum Production (3 hrs)
- C&PE 628 - Petroleum Engineering Design (3 hrs)

If you are a transfer student, either from within KU, from another university or from a community college, you are not required to take C&PE 117 and C&PE 127. Instead you must make up the 2 hours of C&PE 117 and C&PE 127 with 2 hours of math, science, engineering, humanities, or social science (MSEHS). In the case of a student transferring from another engineering department, you may transfer another introductory course for C&PE 117 and C&PE 127.

It is important to note that the C&PE courses are generally only offered 1 time per academic year and are prerequisites for subsequent courses. Failure to complete the courses during the scheduled semester will result in delaying graduation by at least 1 year. It is also important that you recognize that a thorough understanding of the material in these courses is critical to your success in the chemical engineering profession. Earning a “D”, while a passing grade for the course may indicate that you are not suitably prepared for subsequent courses.

## Engineering and Basic Science Electives

ME 211 Statics & Mechanics (3 hrs) is required as an engineering course. In addition, 9 hours of electives are required for a Bachelor of Science degree in Petroleum Engineering. At least 6 elective hours must be engineering courses while up to 3 hours can be a basic science or engineering course. Some engineering courses duplicate material that you are required to take as part of your degree program and cannot be counted as engineering electives. In addition, introductory courses in all departments are not acceptable as engineering electives.