

Doctor of Philosophy in Chemical and Petroleum Engineering

Chemical and Petroleum Engineering

Chemical engineering has grown out of a combination of chemistry and engineering associated with industrial processes. Today, it comprises knowledge used in processes that change the physical state or composition of materials. Chemical engineers hold key roles in the design, development, production, and purification of materials considered essential to human life and well-being, such as food products, fuels and lubricants, pharmaceuticals, fertilizers, synthetic fibers, microelectronic components, and plastics. Chemical engineers are involved in reducing the use of energy to make products in a safe and sustainable way and minimizing environmental impacts. Areas of study in the Chemical Engineering Department include (but are not limited to):

Catalysis (hetero and homogeneous), Reaction Kinetics, Fuel Cells & Energy Storage, Biofuels, Interfacial Phenomena, Biomedical, Drug Delivery, Electrocatalysis, and Photoelectrocatalysis.

Petroleum engineering is concerned with the drilling, recovery, production, and distribution of petroleum and natural gas. Petroleum engineers use knowledge of fluid and rock properties in subsurface environments to produce oil and gas safely and economically. At the University of Kansas, the focus is on reservoir engineering and improving production from oil and gas reservoirs. Reservoir engineers use geological detection with computerized mathematical analysis to produce raw materials. New areas of research are focused on unconventional reservoirs and Net Carbon Zero geoenery using AI and data mining for intelligent and sustainable petroleum engineering. Areas of study in the Petroleum Engineering Department include (but are not limited to):

Data Mining and Artificial Intelligence Supported Reservoir Engineering, Hydraulic fracturing and acidizing of unconventional reservoirs, Characterization and simulation of tight oil and gas reservoirs, Oilfield nanoparticles, CO₂ enhanced oil recovery and CO₂ storage, and Phase behavior of reservoir fluids.

Ph.D. Admission Requirements

To qualify for study in any of the graduate programs in the Department of Chemical & Petroleum Engineering, a student generally must have earned an accredited bachelor's degree and/or master's degree in chemical or petroleum engineering. However, a student with good preparation in another engineering discipline or a related field, such as chemistry, physics, geology, or other engineering disciplines may qualify by taking the appropriate prerequisite undergraduate courses. These courses are determined on a case-by-case basis by the Department's Graduate Admissions Committee/Director.

Application Deadlines

- Fall Priority Deadline: January 5; final deadline March 1
- Spring Priority Deadline: October 1

All application materials must be submitted by the final deadlines, March 1 (Fall semester admission) and October 1 (Spring semester admission). All admitted students are considered for any funding opportunities for

which they qualify. See our Graduate Admissions (<https://cpe.ku.edu/graduate-admissions/>) page or the Graduate Studies website (<http://www.graduate.ku.edu/>) for the application procedure and fees.

Application Materials

- Application (<https://gradapply.ku.edu/apply/>) (online only)
- Statement of Purpose
- Resume or Curriculum Vitae
- Official transcript (<http://graduate.ku.edu/transcripts/>)
- Three letters of recommendation
- TOEFL, PTE, or IELTS-Academic scores (non-native English speakers only)

The following documents are required only after a student has been admitted:

- Financial Statement (International students only if no department funding offer)
- One (1) Official Transcript sent directly from the applicant's university to the University of Kansas

*TOEFL Scores

- Institution Code – 6871
- Program Code – 64

IELTS Scores

- Email an electronic copy to cpegrad@ku.edu.

*As of October 2020, GRE scores are no longer required as part of the application process.

Students admitted with baccalaureate degrees in chemical or petroleum engineering enroll in the graduate core courses listed in our Graduate Program Manual (<https://cpe.ku.edu/degrees/>). Students with degrees in other branches of engineering or in mathematics, chemistry, physics, or other sciences must take undergraduate courses to provide the necessary background for the graduate level courses and are admitted provisionally. See undergraduate prerequisite courses listed in the M.S. Degree Requirements section. Students who have already completed a M.S. degree will have the total number of hours reduced on a case-by-case basis, with the approval of the Graduate Standards Committee, and based on individual background and course history. No credits will transfer in at the Doctoral level; however, the 60 total credit hour requirement can be reduced to as low as 45 credit hours.

All graduate applications must be submitted online (<http://www.graduate.ku.edu/>).

Regular Status

For admission to regular status, the student must have an undergraduate grade point average of at least B (3.0 on a 4.0 scale). For students whose undergraduate GPA is below 3.0, admission on probational status will be considered on a case-by-case basis. Graduate Record Examination (GRE) scores are required.

Foreign Student English Proficiency

To find the most up-to-date information about the University's English Proficiency Requirements, visit the Graduate Studies Webpage (<https://gradapply.ku.edu/english-requirements/>).

Visit Us

Graduate program staff can assist prospective students in determining the fit between the student and the program. Staff can facilitate a campus visit. If you would like to schedule a visit, there are two main options:

The first, and most preferred, entails simply applying for admission to the program. All prospective students are welcome to attend our Open House in mid-October or mid March. Eligible admitted students may be invited to participate in Campus Visit Days in February or March (prior to the fall semester of your intended matriculation). These organized visitation opportunities will allow you to gather a great deal of first-hand information which we hope will help you in making a final decision about whether to attend KU.

The second option is making arrangements to visit us on your own, outside of organized events. With early notification, we will do our best to work with you to provide information and schedule appointments with faculty when possible.

Contact Information

Please contact the CPE Graduate Program Coordinator, cpegrad@ku.edu (cpe@ku.edu) or (785) 864-2900, if you would like to schedule a campus visit, or have questions about the program or the application process.

The University of Kansas
CPE Graduate Program
4132 Learned Hall
1530 W. 15th Street
Lawrence, KS 66045

Ph.D. Degree Requirements

One of the goals of the department is to develop quality Ph.D. researchers who are well prepared for vocational and personal success. This policy sets forth a balanced program to develop and evaluate students in an efficient and fair manner. Equal consideration is given to the academic and the research ability, as both areas are required for success in industry or academia.

The Ph.D. graduate program typically consists of the completion of 60 credit hours beyond the B.S. degree or 45 credit hours beyond the M.S. degree. For more details about the courses and general timeline, see our Graduate Program Manual (<http://cpe.engr.ku.edu/sites/cpe.engr.ku.edu/files/docs/CPE%20Graduate%20Program%20Manual.pdf>).

An advisory committee of 5 or more members is formed for each Ph.D. aspirant: at least 3 tenure / tenure track faculty from the department and 1 member from outside the department at KU are required. The student's research advisor normally serves as the committee chair. See the Graduate Catalog for doctoral committee composition requirements. The committee works with the aspirant to develop a plan of study and monitors the progress of the student throughout the remainder of the Ph.D. program.

A plan of study must be approved by the student's advisor, the examining advisory committee, and the departmental Graduate Studies director by the end of the first semester. Before scheduling the comprehensive

examination, the aspirant must satisfy residency, basic research skills, and the responsible scholarship requirements.

The research skill requirement provides the aspirant with a research skill distinct from, but strongly supportive of, the dissertation research. Work done to fulfill this requirement should involve study in an area complementary to the dissertation research and should enhance the student's ability to carry out the research.

Preliminary Examination of Research - B.S. to Ph.D.

The Preliminary Examination of Research is administered to students requesting admission to the Ph.D. program without earning the M.S. degree. Successful completion of the preliminary examination admits the student into the Ph.D. program with aspirant status. Students taking this examination must have completed the graduate core courses at KU with the required GPA. The examination determines the student's aptitudes for: (a) Independent, original, critical thinking; (b) Planning and organizing a research program; (c) Use of previous work and background literature to demonstrate understanding of the planned research within the scope of the larger project and ability to conduct that research; (d) Application of fundamental theory (e.g., equations) to the proposed work and; (e) Effective communication of technical work. The preliminary examination consists of a written report (5 pages maximum), oral presentation (15 minutes maximum), and questions by the examining committee (25 minutes maximum). The written and oral portions are prepared by the student only, with no review or editing by the research advisor or any other person. The written report is submitted to the committee one week before the oral examination. Questions are directed toward determining the 5 aptitudes listed above. A rubric for the oral and written portions will be provided to the student beforehand.

Comprehensive Examination

The Ph.D. aspirant takes the comprehensive examination after the completion of a majority of the course work for the Ph.D. and all department, school, and general requirements prerequisite to this examination, including residency, research skills, and responsible scholarship requirements. To prepare the aspirant for the comprehensive examination, the advisory committee may require enrollment in C&PE 902, Preparation for the Ph.D. Comprehensive Examination. The examination consists of 2 parts: a written proposal for research and an oral examination based on, but not limited to, the research proposal.

For the research proposal, the student is assigned a topic of current interest to the chemical and/or petroleum engineering profession. This assignment is made by an examining committee of at least 5 persons, at least 3 must be tenure / tenure track faculty from within the department including the advisor and at least 1 person from outside the department at KU. The aspirant identifies a research problem in the assigned topic area and prepares a written proposal for research on this problem. Normally, the written proposal must be prepared over a specified time period of 30 consecutive days. Except in unusual circumstances, the problem must be distinctly different from the dissertation problem.

The examining committee evaluates the research proposal upon completion. If the committee judges it satisfactory, the oral examination part of the comprehensive examination is held. The oral examination is based on the research proposal but may also cover areas peripheral to the proposal.

A student must pass both parts of the examination. Failure of either part constitutes an unsatisfactory grade on the entire examination. An aspirant who receives a grade of unsatisfactory may repeat the examination upon

the recommendation of the examining committee, but the exam may not be taken more than twice. The examination may not be repeated until at least 90 days have elapsed since the unsuccessful attempt. On receipt of a grade of Honors or Satisfactory on the comprehensive examination, the aspirant is admitted to candidacy for the degree of Doctor of Philosophy.

Ph.D. Dissertation and Final Oral Examination

The doctoral dissertation, based on independent research conducted by the candidate, constitutes the final phase of the doctoral work and must be completed within the prescribed time constraints. Upon acceptance of the dissertation by the advisory committee, the candidate defends the dissertation in a final oral examination. The examining committee consists of at least 5 persons, including the advisory committee members and at least 1 person from outside the department.

MS to PhD Program

If a student obtains their MS degree in Chemical or Petroleum Engineering from the University of Kansas and plans to continue on into the doctoral program, then the GPA from the core courses will be used as the basis for entering the PhD program. If the student obtained their MS degree in Chemical or Petroleum Engineering (or very closely related fields) from another university, then the student's MS course work is evaluated by:

The Graduate Standards Committee (GSC) will determine if 1 to 5 (4 PE) of their MS core courses will count toward the requirements to become a PhD aspirant. A minimum of 45 credits must be completed at KU for Ph.D. degree completion.

Course Requirements:

Core Courses: Minimum of 12 credit hours for Petroleum Engineering and 15 credit hours for Chemical Engineering (or equivalent as approved by GSC)

Elective Courses (15 hours): 3 CPE Courses; 2 courses from outside CPE (7XX or greater)

Graduate Seminar: Every semester while in residence

Research: 30-34 hours

- PhD Aspirants: Average GPA of **3.2 (5 course core) or 3.25 (4 course core)** in core courses. A student below the required GPA will need to decide with the Advisor to 1) retake courses until GPA is obtained; 2) be dismissed from graduate program.
- 3.25 Overall GPA
- Only one C may be obtained. If more than one C is obtained, the student will be placed on departmental probation
- **Preliminary Examination:** See Policy and Rubric on departmental website.

BS to PhD Program (Fast track PhD)

Course Requirements: Minimum of 60 total credit hours

Core Courses: See list of Graduate Core Courses in the MS Degree section

Elective Courses (15 hours): 3 CPE Courses; 2 from outside CPE (7XX or greater)

Graduate Seminar: C&PE 800 Every semester while in residence

Research: 30-34 hours

- PhD Aspirants: average GPA of **3.2 (5 course core) or 3.25 (4 course core)** in core courses from KU MS degree. A student below the required GPA will need to decide with Advisor to 1) retake courses until GPA is obtained; 2) obtain the MS degree while pursuing the PhD program.
- 3.25 Overall GPA required in all courses
- Only one C may be permitted
- **Preliminary Examination:** See Policy and Rubric on departmental website.