PRESENTING:

CEE's Annual

Grad Guide

for 2022-2023

The following pages feature schools that offer graduate education programs in chemical engineering and related fields. By advertising their programs in this annual graduate education issue these schools have financially supported *CEE*'s ability to continue serving the needs of the international community of educators in chemical engineering.

CEE (Chemical Engineering Education) is the premier archival journal for chemical engineering educators.

Ad information packets are sent to ChE departments in May and the ad copy deadline is July 1.

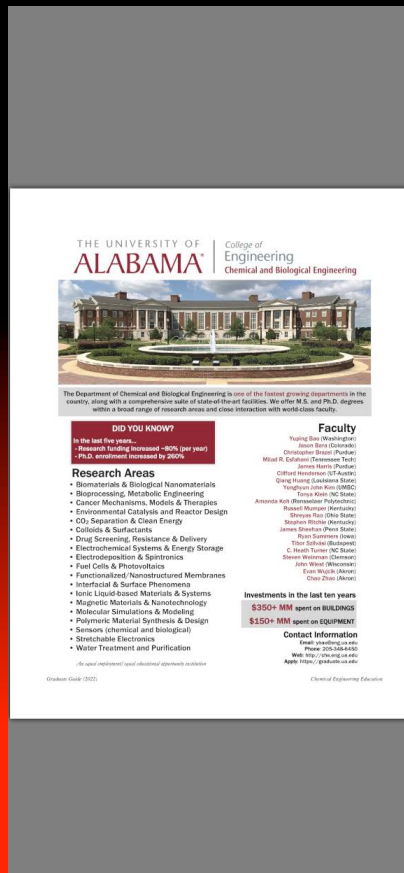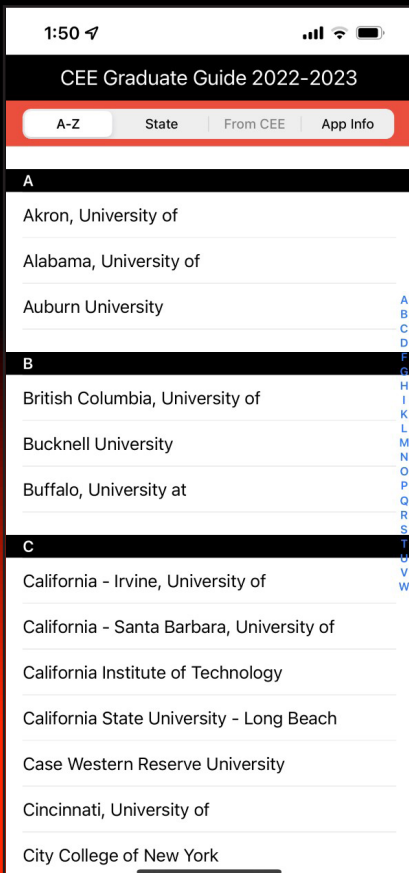# Information on Chemical Engineering Graduate Programs

Interested in graduate school in Chemical Engineering, but not sure where to start?

Chemical Engineering Education is pleased to offer a free iPhone/iPad app that provides information and direct links to graduate programs in the US and abroad.

The graduate school information can also be accessed from a browser. Go to:

https://cee.che.ufl.edu

and click on "Graduate Guide"

AN INSIDER'S GUIDE TO SUBMITTING A WINNING GRADUATE SCHOOL APPLICATION

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Any chemical engineering student considering graduate studies should consult two valuable resources that are found in *Chemical Engineering Education*. In the introduction to the 2021 Graduate Guide, Visco[1] provided perspective, guidance, and information about engineering graduate studies. Aided by the journal editorial team, Visco contemplated, "How was graduate school different from your undergraduate experience?" and five related questions. Along similar lines, in 2019 Wankat[2] presented a detailed analysis of the question "Is Graduate School Next?" Professor Wankat discussed reasons for attending (or not attending) graduate school and provided details regarding the structure of different types of engineering graduate programs. For those who answered, "Yes, graduate school is next," he illustrated use of Kepner-Tregoe decision analysis to select the best graduate programs to apply to. To use the Kepner-Tregoe approach, a student identifies key factors that they desire in a graduate program, weights these factors according to their importance, and rates prospective programs for each factor. Addition of the weighted scores results in a cumulative score for each program. The Kepner-Tregoe approach is a rigorous method of selecting the graduate programs that best match each student's interests and motivations.

Professor Wankat provided advice on a number of high-level considerations about the application process, including applying to more than one program, but limiting the number of programs you apply to; however, he didn't go into the details of how to effectively prepare the required components of a successful graduate school application. Graduate engineering programs have limited space available, meaning that reviewers can be very selective regarding acceptance into their programs. In particular, PhD programs, which require considerable research and associated funding, can be highly competitive. As such, the application process should not be rushed through or taken lightly, as acceptance depends upon your ability to highlight your previous accomplishments and demonstrate your potential for successful completion of a graduate engineering degree.

Having reviewed countless applications, and too often witnessing students fall prey to common pitfalls, we wanted to offer some practical advice to students as they begin applications to engineering graduate programs. Similar to our previous article[3] that focused on searching for a faculty position, the perspective that we offer is of reviewers who would like to share what we believe constitutes a compelling application and what can negatively impact reviewers' impressions. One of the main goals of this article is to demystify the graduate application process, thereby leveling the playing field for all applicants. A combination of transparency regarding the process and a better understanding of reviewer expectations will hopefully widen the pool of eligible students applying for these highly competitive graduate engineering positions.

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Applicants should keep in mind three overarching principles when completing graduate school applications: (1) be thorough and concise, (2) be accurate, and (3) be professional.

BE THOROUGH AND CONCISE

Being thorough begins with providing all of the information required for a complete application. We're routinely contacted by prospective students asking why they haven't heard a decision about their application. More often than not, the reason is that their application isn't complete. With automated processing systems, an incomplete application won't move forward for review. The online submission tools do, however, allow *you* to check your application's status and identify missing elements. As required components can vary between institutions, one suggestion is to create a checklist for each application to ensure that you have included all necessary documents and information. As you synthesize your written statements for these applications, being thorough should be balanced with being concise. Application reviewers are typically busy faculty members who are not happy when faced with wading through long-winded expositions. Rather, to impress the reviewers, you need to craft a direct, succinct presentation of the requested information, and to accomplish this effectively will take time and several drafts. To aid your efforts to be concise, avoid the urge to pad your answers or overstate your credentials. For example, being proficient in mammalian cell culture techniques is a skill worth noting, whereas attending a seminar about cell cultures is not.

BE ACCURATE

In addition to being thorough, the information you submit must provide an accurate and complete picture of you, your preparation for graduate studies, your reasons for wanting to attend graduate school, and any unique circumstances that you wish to share with the reviewers. Being accurate is comprised of two related, but distinct, aspects. First, tailor your application to each program you're applying to. Applications to a course-option MS program, a traditional doctoral research program, and a doctoral program that includes a significant engineering education component should emphasize different points, including why you feel that style of program is the best fit for your future career path. Even applications to similar types of programs at different universities should have unique features based on the nature of the individual programs. Reviewers at top-tier research universities will view graduate applications through a different lens than reviewers at primarily undergraduate institutions, so tailor your applications appropriately. If you followed Wankat's approach to selecting the programs that you're applying to, you'll have a good understanding of what each program emphasizes. This knowledge can be used to fashion applications that demonstrate that you've done your homework and have a foundational sense of the program components, research areas, and key faculty, which will make a positive impression on reviewers. For example, you might describe your reasons for wanting to take a particular course sequence in a course-option MS program, or for a doctoral program you should identify faculty that you want to work with based on alignment of research interests.

Even if you prepare program-specific applications, each application can still share significant content, making a common template for information organization exceptionally useful. While this approach saves considerable time and effort, it leads to the second aspect of being accurate on your applications. Sharing information among a number of applications, through the use of a template or by copying information from a different application, has the downside of increasing the chance of including erroneous content. Every reviewer has seen applications that have been accidentally written to a different program. Trust us, a reviewer at University X doesn't want to read how much you're looking forward to attending University Y. So proofread your applications, and then proofread them again to limit the chance that you commit such an application faux pas.

BE PROFESSIONAL

Part of what is learned during undergraduate studies is the engineering culture and expected behaviors of practicing engineers. After you complete your undergraduate studies, you'll transition into the professional world of engineering. Although graduate school is still school, there are expectations of professional behavior (that aren't all that different than those for upper-level undergraduates and new graduates entering the workforce). This is particularly true for students receiving funding for carrying out research and teaching assignments, as both of these roles come with high performance expectations. Your application should convey that you've learned how to behave in a professional manner. This doesn't require an overly stuffy approach, but you should avoid being too informal and leaving reviewers with a negative or off-putting impression. For example, a recent graduate school applicant was exchanging email messages with potential research advisors. The personal photo on these messages was not of the applicant, but a cartoon image of SpongeBob SquarePants® riding a seahorse. This innocent example illustrates how easy it can be to create an unintended, and potentially unprofessional, impression. The good news is that in this case the oversight was inconsequential; the student in question is approaching completion of their doctoral studies with an advisor whose first visual impression of them was a popular animated undersea character.

Another critical aspect of professional behavior is meeting deadlines, and applying to multiple graduate programs will certainly present you with numerous and varying deadlines. As mentioned earlier, a university-program specific checklist should facilitate staying organized and meeting these deadlines. Moreover, Swindlehurst and Bullard[4] have prepared a helpful timeline for key action items when applying to graduate school, starting with searching for fellowship opportunities and taking the GRE®, moving on to developing a pool of candidate programs and submitting applications, and culminating in selection of your graduate school destination. For many programs, these deadlines are strictly enforced. In addition to showing a lack of professionalism, submission after the deadline may result in an immediate rejection of your application. We know that senior year of undergraduate engineering studies can be very time consuming, but keep a focus on your future path and don't miss these application deadlines!

Graduate school applications include a number of standard "information gathering" aspects, including an application questionnaire (name, address, location of undergraduate studies, GPA, etc.), official transcripts from all undergraduate universities, and test scores (if required). These should be fairly easy and straightforward to complete; however, two parts of a graduate school application that should receive special attention during preparation are recommendation letters and the personal statement. These items give reviewers a more complete picture of an applicant, a picture that goes beyond the list of courses and grades on an academic transcript.

Recommendations

Most graduate school applications require multiple recommendation letters that help reviewers by providing a third-party viewpoint of the applicant's accomplishments, strengths, and unique situations. These recommendation letters can have a tremendous impact on your application, as they help describe you on a more personal level and can include activities and perspectives from outside the classroom, both of which graduate school reviewers will look to evaluate. Although you likely won't see your recommendations, you can still influence the recommendations through careful selection of and thorough communication with recommenders. Obviously, faculty and work supervisors who have interacted with you outside of the classroom, preferably having directly overseen your work, are better than faculty members who only know you because you were on their class list. Additionally, a departmental academic advisor who is knowledgeable about your entire academic experience and future career aspirations may be a good choice to provide recommendations. Goldberg[5] recently shared what she requires of students asking for recommendation letters. The guidelines provided in this resource are useful for selecting recommenders (for example, applicant has "interacted with me in a meaningful way outside of class or through consistent class participation") as well as specifying information the applicant must provide to help in preparation of an effective letter (such as "Briefly describe the opportunity. Why are you interested in this opportunity?"). To kill two birds with one stone, we suggest that you provide your recommenders with a copy of your personal statement. This provides recommenders with information they need, and they are able to provide feedback on how to improve your personal statement. Through a combination of your personal statement and open discussions, your recommenders will be able to write a more in-depth, personalized portrayal of your academic history and motivations for pursuing a graduate degree, both of which will be important during review.

We're aware of some graduate programs that no longer request recommendations because the information provided is thought to be of limited value due to lack of accuracy. Glowing recommendations of a student with below average grades will at best confuse a reviewer and at worst cast doubt on the veracity of the application. It's true that grades aren't always the best indicator of potential, so a recommendation that addresses an applicant's average grades *and* provides evidence of why the applicant can succeed in graduate school will be more convincing to a reviewer. In summary, our advice regarding letters of recommendation is to select your recommenders carefully and provide them with the information they need to provide valuable support of your application.

Personal Statement

The personal statement is your best opportunity to help reviewers get to know you beyond your academic transcript from your perspective. Additionally, this section of the application is your chance to demonstrate your writing abilities, a skill prized in graduate students. The statement should be succinct, yet thorough. It shouldn't merely list courses that are on your transcript, as that doesn't capture what is unique about you. That doesn't mean that you should completely avoid mentioning your undergraduate coursework, particularly if you found specific courses and/or instructors instrumental in your decision to pursue graduate studies. Key points to convey in the personal statement are how you got to your current status, why you want to attend graduate school, and the position you hope to be in when you've completed your graduate studies. You should note your areas of research and study interest so reviewers can determine if these are a match for their program. Experiences and accomplishments that have prepared you for graduate studies should be described (cooperative education work, research experiences, etc.), but don't get bogged down in the technical details of what you did; rather, discuss the skills they helped you develop and how the experiences have prepared you to succeed in graduate school. One possible structure of a personal statement is to

begin with general information about yourself and build to specific points about how you are a good fit for a particular program (and how the program is a good fit for you).

Many graduate programs, particularly at the doctoral level, emphasize research, and you might wonder if undergraduate research is required for graduate school acceptance. If you don't have research experience and are applying to a program with a research component, your personal statement provides the opportunity to explain how your previous experiences, perhaps in industry or coursework, have pointed you in this direction. The undergraduate experience is a time of significant change that includes determination of future direction. It's understandable that some students will develop a desire to pursue graduate studies and research through mechanisms other than an undergraduate research experience. While a track record of undergraduate research is not required for graduate applications, it is imperative that you describe your experiences and decisions that got you to this point in your academic career.

As with recommendations, a personal statement should address, not ignore, negative aspects of your background. Perhaps you struggled academically during one term due to overextending yourself or you were dealing with an illness. You have the chance to explain these points as well as highlight more positive accomplishments (maybe your grades improved following a rough start to your engineering studies). There is a difference between discussing circumstances that caused poor performance and simply listing excuses. While reviewers are generally understanding, they don't want to hear excuses.

If you're changing fields between your undergraduate and graduate studies, reasons for this should be addressed in the personal statement as well as why you feel this new field is a better fit for you and your career path. Switching from chemical engineering to chemistry (or the other way around) is not unusual, but most reviewers will be intrigued and want to hear why you're doing this. Switching from chemical engineering to fine arts doesn't happen very often, so if you don't explain your motivation, a reviewer may be inclined to question the application. Your personal statement is also where you should customize your application to each program by calling out specific faculty, research focus areas, and courses that you are interested in exploring in more detail, should you be accepted. Another avenue of customization is discussing the attractions of the university at large or its location. Discussing the mission of the university or on-campus and local attractions demonstrates to the reviewer that you specifically spent time researching their program and school.

Many students find it difficult to write a personal statement, perhaps due to discomfort over writing about themselves, feeling the need to sell themselves, or not being sure what to say. If you're struggling to construct a personal statement, your current university likely offers help to job seekers and graduate school applicants. Additionally, the universities and programs you're applying to probably provide guidelines about what they're expecting, which can be found on their websites. For example, the Career Center at the University of California Berkeley provides online advice, including a handy list of dos and don'ts, for composing an effective statement of purpose.[6]

If considered a suitable alternative by a program you're applying to, a resume may be substituted for a statement of purpose; however, you must weigh the simplicity of submitting a resume against the missed opportunity to give reviewers a more complete picture of you and your academic journey via a personal statement. If you choose to submit a resume, it must include a strong objective statement that conveys your reasons and aims for attending graduate school. Some programs request a statement of purpose (what you want to do) as well as a personal statement (who you are), so be sure to provide the correct items for each program that you apply to. Also, while these two items are closely related, they should mesh together effectively while avoiding repetition. Preparing an impactful personal statement is not an easy task and will take several iterations, so make sure you budget enough time to do this well.

Reaching Out

To complete a quality application, you'll need specific information about the programs that you'll be applying to. While almost all of the application process, including application and program information, is handled online, finding specific details can be challenging and frustrating at times. In these cases, you should reach out to get the information you need. There are people in every program, such as the individuals writing this article, whose job description includes helping graduate applicants. You should direct program specific questions to these people. For example, perhaps you want to pursue an MS degree in chemical engineering but see that the school also has an engineering management program. Given your desire to head into industry following completion of your MS degree, you want to know if engineering management electives can be incorporated into a chemical engineering MS study plan. This type of question can only be answered properly by someone with in-depth program knowledge and thus should be directed to someone within the program. Other, more general, questions should be directed to the university graduate admissions office. For example, international applicants are usually required to provide proof of English language proficiency, but you would like to know if this requirement can be waived. While an engineering professor may know the answer to this question, it's likely that the requirement originates from the university, not a specific program. In a case such as this, the admissions office will be a better source of reliable and complete information.

While you are always welcome to contact a program with questions, remember to display professionalism, accuracy, and thoroughness in this correspondence. In particular, resist the urge to submit a laundry list of questions. As noted previously, much of this information should be available online, so don't place the burden of finding answers on someone who may review your application once it's complete.

If you're planning to perform research during your graduate studies, contacting prospective advisors can be the most impactful part of the application process. Graduate research is a significant time and energy commitment for both the student and the faculty advisor, so it's important to find the best possible fit for all involved parties. Communicating directly with faculty is the best way to get up-to-date information about research projects, funding opportunities, and availability of open positions for new students. Remember that these faculty are busy, so you'll want to make it clear that you're respectful of the value of their time and make the best possible impression when interacting with them. Visco[7] has provided helpful advice on how to effectively contact faculty members (including "use proper salutations … don't leave this part blank or use something like … "Hey!""; be specific about your interest in their research). Use of online tools with video, such as Zoom®, has become increasingly popular, so you may be asked to meet face to face, which can be a bit nerve wracking. Try to relax by remembering that faculty won't aim to trip you up with tricky questions; rather, their goal is the same as yours – to determine if there's a match between your interests and goals and theirs. If you are fortunate enough to find a faculty member who is willing to work with you prior to your application being submitted, make sure to highlight this in your personal statement. If reviewers know that there is an existing research match, this speaks highly of your skills and can make a significant impact on their decision. While some programs are open to students lining up research advisors in advance, others are not. You should be aware of the process followed by each program to which you're applying to know whether or not this approach should be considered and if it will guarantee a particular advisor (or not).

Remember, all communications with faculty and graduate program representatives should be treated in a professional manner, not informally like your communications with friends and family. If videoconferencing, don't plan on leaving your camera off, which can be viewed as a sign of disrespect. Also, make sure you are conducting video meetings in a professional setting with minimal background noise and distractions. Asking questions about the application process and contacting potential research advisors will likely be your first contact with a program, and as Professor Visco[7] notes, you only get one chance to make a first impression (right, SpongeBob?) Further, interactions with faculty should be incorporated into your application. Use what you learn to improve your personal statement and tailor it to a specific program. To increase the chances of your acceptance, contacts with faculty should be noted in your application to make all reviewers aware that you've taken steps to develop a personal relationship with their program.

In conclusion, completing a winning graduate school application is not an easy proposition, and there is no magical solution to ensure acceptance into highly competitive graduate engineering programs. However, we are hopeful that the preceding advice will help you understand and successfully navigate the application process. Also, remember that you are surrounded by a community of people who can help you on the journey, including faculty, advisors, friends and family, and graduate program directors at universities that you are applying to. We wish you the best of luck and hope that you enjoy your forthcoming graduate experiences.

ACKNOWLEDGMENTS

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