

EXPLORING GRADUATE STUDIES: Chemical Engineering

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Office of Academic Advising and Student Success

After students finish their undergraduate degree, they can pursue professional development or further studies (or both). In either case, it is important to make an informed decision as soon as possible. With regards to the latter, **the earlier students decide about pursuing graduate studies, the more they can do to improve their chances of admission**, therefore this handout has been designed to facilitate the process for candidates wishing to pursue graduate studies.

This is a summary document outlining **what students need to do during their undergraduate degree and what fresh graduates may need to do** to be better prepared for applying to a graduate school. Please note this resource was last updated on **01/07/2022**, and some information may be outdated, therefore after closely reviewing the information below we encourage readers to consult with relevant faculty, alumni from your field of interest, and other people who have pursued higher education to learn more. **For in-depth information on graduate programme exploration, career prospects, graduate school application process, funding, and more, please check out the detailed document [here](#) (under development).**

| CONTENTS

| SECTION 1: ACADEMIC BACKGROUND

Are there any Degree requirements?	2
<i>Country-Specific considerations</i>	2
Are there any Coursework requirements?	3
Are there any GPA requirements?	3
What does this mean for LUMS Students?	5

| SECTION 2: NON-ACADEMIC BACKGROUND

Are there any Research Experience requirements?	6
Are there any Work Experience requirements?	6
Are there any Extracurricular Experience requirements?	6
What does this mean for LUMS Students?	6

| SECTION 3: APPENDIX

Sources you should consult for more information	7
Online Resources Consulted	7
Contributors	7

SECTION 1: ACADEMIC BACKGROUND

- A. Are there any Degree requirements?
- B. Are there any Coursework requirements?
- C. Are there any GPA requirements?
- D. What does this mean for LUMS Students?

Are there any Degree requirements?

Note: Below are some general requirements and guidelines -- students should research or make sure to contact their prospective programmes in advance to find out their exact degree requirements.

- **For Masters:**
 - **Students are highly encouraged to pursue an undergraduate degree in Chemical Engineering or a closely related field (e.g., chemistry, biology, or other engineering disciplines - like materials science, environment engineering, etc.)** because they cover the required/recommended coursework.
 - **Admission committees highly value students that have an undergraduate degree in Chemical Engineering or a closely related field** as it goes to show passion and a genuine interest in the field and the undergraduate courses offered in the above majors are part of graduate programmes' course requirements.
 - **For applicants that lack the relevant academic/non-academic background needed to be successful in a Master's programme, some universities offer a one-year pre-Masters Engineering programme.** Upon satisfactory completion of the pre-Masters programme, students may be admitted into the university's Master's programme.
- **For Ph.D.:**
 - **A general requirement is having an undergraduate degree in Chemical Engineering or a closely related field (e.g. chemistry, biology, and other engineering disciplines).**
 - **Some universities may also require a Master's degree in Chemical Engineering or a related field.** This requirement tends to vary across countries and programmes therefore students should make sure to contact the programme to find out if they will accept their credentials because some programmes are very strict in their Ph.D. admission requirements.

Country-Specific considerations

- **For the UK:**
 - Master's and Ph.D. programmes generally require students to have an undergraduate degree in Chemical Engineering or a closely related field that is equivalent to a [UK 2:1 honors degree](#).
 - Ph.D. programmes usually require students to have a Master's degree in Chemical Engineering for Ph.D. eligibility. Students are highly encouraged to pursue a research-oriented Master's degree since doctoral programmes are highly research-intensive.
- **For Canada:**
 - Masters programmes can accept qualified applicants with degrees in other fields of engineering. Graduates with non-engineering backgrounds may be admitted under special arrangements which might involve the completion of certain undergraduate engineering courses.
 - Ph.D. applicants may be required to have a research-oriented Masters' degree in Chemical Engineering or a closely related discipline (e.g. Materials Engineering) to be eligible for admission.
- **For the US:**
 - Students are highly encouraged to pursue an undergraduate degree in Chemical Engineering for Master's admissions but universities may also consider students in closely related fields (chemistry, biology, or engineering).
 - For Ph.D. admissions, applicants should have a bachelor's degree in chemical engineering or other closely related fields. However, some Ph.D. programmes may also require a Master's degree in Chemical Engineering or other closely related disciplines..

Are there any Coursework requirements?

Note: Coursework requirements for graduate study are the reason why early planning is important because many courses may have prerequisites, and it takes advance planning to fit this sequence of courses in undergraduate studies. Therefore, students should reach out to their faculty and make sure to contact their prospective programmes in advance and find out what the exact course requirements are.

General Information

The following are some courses that are considered useful for a Master's degree in this field.

For students interested in pursuing a Ph.D., the courses listed below are highly recommended to be taken as part of their undergraduate degree.

- **Chemical Engineering related courses:**
 - Principles of Chemical Engineering
 - Engineering Mathematics
 - Chemical Engineering Laboratory
 - Transport Phenomena
 - Chemical Engineering Thermodynamics
 - Separation Processes
 - Chemical Kinetics
 - Reaction Engineering
 - Chemical Process Control
 - Chemical Process Design
- **Chemistry courses:**
 - Principles of Chemistry
 - Physical Chemistry
 - Organic Chemistry
- **Physics courses:**
 - Mechanics
 - Electricity and Magnetism
- **Mathematics courses:**
 - Calculus I
 - Calculus II
 - Ordinary Differential Equations
 - Probability
 - Linear Algebra

For Top-Tier programmes

Note: If students are interested in admission to a top-tier programme in Chemical Engineering, then in addition to the above, they should consider the following suggestions as well.

- **Most top-tier programmes expect that students have A's in their Undergraduate courses.** However, admissions committees holistically look at a student's undergraduate transcripts. For example, if a student did not do well in a few advanced classes but has extensive research experience then it may be perceived positively. However, acceptance into the programme is entirely up to the discretion of admission committees.
- **Top-tier programmes generally focus on the elective courses that the student has taken and whether they align with the student's research interests/experience.** For example, if a student is interested in sustainable energy, then they should have taken courses that cover renewable energy resources, air pollution control, etc.

Are there any GPA requirements?

Note: The following requirements are general-- it is possible that universities may have higher or lower standards for entry.

Also note: Requirements vary according to country and programme -- it is recommended that students contact their prospective programmes and check the requirements of their shortlisted programmes.

General Information

Note: For more tips on coursework and GPA, check out these [general tips \(under the tab of 'Transcripts'\)](#)

- **For Masters:**

Note: Generally, an undergraduate CGPA greater than 2.4+ is required. Research/Thesis-based Master's programmes will have higher GPA requirements.

- **For the US/Canada/UK:** An undergraduate GPA of 3.0+ is preferred

- **For Ph.D.:**

Note: Applicants to Ph.D. programmes should exceed the GPA requirements of the Master's programme.

- **For the US:** An undergraduate GPA of 3.2+ is generally preferred. For schools that may require a Master's degree, a Master's degree with a GPA of 3.3+ is preferred.
- **For Canada:** An undergraduate GPA of 3.0+ is preferred. For schools that may require a Master's degree, a Master's degree with 75%+ is preferred.
- **For the UK:** An undergraduate GPA of 3.3+ and a Master's award at Merit level (60%+) or above in a discipline directly relevant to Chemical Engineering, or other equivalent international qualifications.

For Top-Tier programmes

- **For Masters:**

Note: Generally, an undergraduate CGPA greater than 3.2+ is required for Top-Tier programmes. Research/Thesis-based Master's programmes will have higher GPA requirements.

- **For the US:** An undergraduate GPA of 3.5+ is recommended.
- **For Canada:** An undergraduate GPA of 3.2+ is recommended.
- **For the UK:** An undergraduate GPA of 3.7+ is recommended.

- **For Ph.D.:**

Note: Applicants to Top-Tier Ph.D. programmes should exceed the GPA requirements of Master's programmes.

- **For the US:** An undergraduate GPA of 3.7+ is strongly recommended.
- **For Canada:** For admission after undergraduate, an undergraduate GPA of 3.8+ is recommended. For schools that may require a Master's, applicants may be expected to have an undergraduate GPA of 3.3+ along with an honors Master's degree in Chemical Engineering.
- **For the UK:** An undergraduate GPA of 3.7+ and a Master's at Distinction-Level (70%+) in Chemical Engineering or a closely related field is required. While GPA is one metric, admissions committees generally focus on the course and research work undertaken by applicants for their Master's degree.

If you are weak in an area (needed/useful for entry into this programme) you should

- **If you don't have a bachelor's degree in Chemical Engineering or a related field:** For overseas admissions, students are generally expected to have an undergraduate degree in Chemical Engineering or a closely related Engineering field (this is especially true for Chemical Engineering graduate programmes in Pakistan). However, it may still be possible to secure admission in a graduate Chemical Engineering programme without an undergraduate degree in Chemical Engineering. If you have a more non-traditional academic background, you would need to present strong evidence of a solid understanding of Chemistry and Chemical Engineering-related concepts. For example, through relevant work experience as a researcher in the field of Chemistry or one of the subfields of Chemical Engineering, or involvement in academic/individual research projects with a substantial quantitative component.
- **If you have graduated and could not take relevant coursework in your undergraduate/Master's:** You can take online courses on the subject (if available) and/or audit relevant courses. Otherwise, you can compensate through other application components, e.g. strong GPA, work/research experience, letters of recommendation supporting your capabilities for graduate studies in this field, etc. If the coursework is a requirement of the programme and for some reason, you are unable to take it (online/audit), then you should contact the programme and ask for relevant pathways (sometimes they may allow you to take the course in their university or may offer alternatives).
- **If you do not meet the minimum GPA requirements:**
 - You should always aim for a high GPA however if your GPA is lower than what is required, then you are highly recommended to contact the programmes of your interest and ask them if there are any actions you can take to still be considered.
 - Strengthen your other application components:
 - If you are still in university (undergraduate or Master's), then take more courses that are required by the specific graduate programme and do well in them, make good relations with top-level relevant faculty, and get strong letters of recommendation, get more research and/or professional experiences.
 - If you are about to graduate (senior in your undergraduate studies or your last semester of Master's studies) and can not do some of the above (coursework, faculty interaction, increase GPA, etc.), then focus on getting relevant research experiences with well-known organizations/research institutes or well-known employers/researchers, to show that you are capable of research work in your graduate studies despite your low GPA.
 - Write a strong personal statement highlighting, i) why you should be considered despite the lower GPA, and ii) reasons for your low GPA (if you have valid ones). It would be ideal if your recommenders support this too (in the letter).

What does this mean for LUMS Students?

- LUMS students should reach out to [Chemical Engineering faculty](#) for guidance related to Chemical Engineering graduate programmes, letters of recommendation, and other graduate studies application tips.
- It would also be helpful to reach out to the Chemistry/Biology/Physics/Mathematics/Electrical Engineering faculty in [SBASSE](#), for similar guidance regarding degree, coursework, and choosing a minor.
- LUMS students could also benefit in a similar manner by reaching out to Teaching and Research Fellows that have Master's in Chemical Engineering or a related degree and are often aspiring for Ph.D. programmes in Chemical Engineering themselves.
- LUMS students should reach out to their respective [Academic Advising Unit \(AU\) staff](#) early for careful course planning given the recurring issues in enrollment at LUMS.
- For information regarding majors offered at LUMS, students should check the [Undergraduate Student Handbook](#) (please download the handbook relevant for your academic year).
- LUMS students should refer to the [course memos](#) (courses being offered in a specific semester and their requirements) for a more updated list of courses and the [course outlines](#) (resources to help students understand the course) to know the topics being taught within those courses.
- For information regarding the various academic/non-academic related support services at LUMS, please check [here](#).

SECTION 2: Non-Academic Background

- A. Are there any Research Experience requirements?
- B. Are there any Work Experience requirements?
- C. Are there any Extracurricular Experience requirements?
- D. What does this mean for LUMS Students?

Are there any Research Experience requirements?

Note: Students should reach out to their faculty and contact their prospective programmes in advance and find out what the exact research experience requirements are.

- **Research experience is not a requirement for Master's admissions but can be a plus** especially if students are planning on pursuing a research-oriented programme. Students that have been Research Assistants are more likely to get excellent letters of recommendation through which they can demonstrate their passion for the field. Furthermore, they can also mention their research experiences in their personal statement.
- **Research experience is very important for Ph.D. admissions.** Generally speaking, all applicants to a Ph.D. programme will have high GPAs therefore, what distinguishes Ph.D. applications is whether students took the initiative to engage in knowledge generation and how compatible their research goals are with potential graduate advisors (this will greatly impact the student's overall Ph.D. experience and play a critical role in the success of his/her thesis or dissertation work). Undergraduate students should, therefore, plan on getting involved in research as it will allow them to explore their interests, contribute to the larger academic field (even at a low level), and build connections that can help them connect with the right graduate advisors.
- **Ph.D. programmes may require applicants to be referred by one of their research advisors** for which students would have to discuss and map out their research topic. Therefore, students should plan on getting research experience to identify the research field they would like to obtain their doctoral degree in.
- Students should try spending time researching the areas of active research and the faculty conducting that research in the department of interest, and then address these areas in their statement of purpose. Additionally, publishing helps a lot and shows prior research experience.

Are there any Work Experience requirements?

- **For Master's admissions work experience is not required but can be good to have** since industrial experience can provide practical examples to apply as students study and research new material. Furthermore, having prior work experience can enable students to make more out of their Master's degree professionally.
- **Work experience is not required and is usually irrelevant for Ph.D. admissions** unless students have experience working in an academic or industrial research lab. Students can also find internships in labs helpful as the experience can be mentioned in their personal statements.

Are there any Extracurricular Experience requirements?

- **Extracurricular experiences are not required for both Master's and Ph.D. programmes.** However, having extracurricular experiences does not harm a student's application as it can help students broaden their vision, provide them with insights on what to pursue later in their life, and above all, make them more passionate about and interested in different fields.
- Students can join engineering-related student clubs and societies, participate in science-related university competitions, and attend talks by Chemical Engineers and Chemical Engineering faculty to show how well-rounded they are and highly passionate about the field.

What does this mean for LUMS Students?

- LUMS students should reach out to [Chemical Engineering and Chemistry faculty](#) for graduate programme selection guidance, letters of recommendation, Research/Teaching-Assistantship guidance, and other graduate studies application tips.
- LUMS students should contact the [Career Services Office](#) to get assistance in areas of career planning and work experience opportunities. Students should also reach out to alumni using online platforms such as the [LUMS discussion forum](#).
- For an updated list of clubs and societies operating under the LUMS Office of Student Affairs (OSA), please check [here](#).

- For information regarding undergraduate research opportunities, please check. [here](#).

SECTION 3: Appendix

- A. Sources you should consult for more information
- B. Online Resources Consulted
- C. Contributors

Sources you should consult for more information

- [Admissions Overview of Chemical Engineering](#) by Stanford University's Department of Chemical Engineering
- [Admission Guide for a PhD programme](#)
- [Chemical Engineering Masters programmes in Pakistan](#)
- [Research Areas in Chemical Engineering](#)
- [Masters in Chemical Engineering Expectations](#) by Columbia University

Online Resources Consulted

- [Top Chemical Engineering programmes in the US](#)
- [Chemical Engineering programmes in Canada](#)
- [Chemical Engineering Doctoral programmes in Canada](#)
- [Top Chemical Engineering programmes in the UK](#)
- [List of Research Topics/Areas in Chemical Engineering](#)

Contributors

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