

EXPLORING GRADUATE STUDIES: Electrical Engineering

Authored by: Ammar Khalid | **Design by:** Haroon Masroor | **Reviewed by:** | Dr. Muhammad Tahir (Assistant Professor; LUMS) | Dr. Abubakr Muhammad (Associate Professor; LUMS) | Dr. Ijaz Naqvi (Associate Professor; LUMS)

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 can decide that they might want to go for 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 graduate school. Please note this resource was last updated on **07/20/2022**, and some information may be outdated, therefore after closely reviewing the information below we encourage readers to consult with faculty, alumni from your field of interest, and other people who have pursued this graduate degree 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 doc [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?	4
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 and find out what the exact degree requirements/guidelines are for those specific programmes.

- **For Masters:**
 - **Students are highly encouraged to pursue an undergraduate degree in Electrical Engineering or a closely related field (Mechanical Engineering, Telecommunication Engineering, Computer Engineering, Physics, Math) from an accredited institution** because they cover the required/recommended coursework and due to the highly quantitative nature of the degree.
 - **The admission committee places more emphasis on how many undergraduate courses applicants have taken in preparation for the programme's course requirements.**
 - **For applicants that may be lacking the relevant academic/non-academic background required to be successful in a Master's programme, some universities may 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 Electrical Engineering or a closely related field (e.g. Computer Engineering, Software Engineering, Physics, Math, etc.).**
 - **Some universities may also require a Master's degree in Electrical 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 admissions requirement for a Master's in Electrical Engineering)

Country-Specific considerations

- **For the UK:**
 - Master's and Ph.D. programmes generally require students to have an undergraduate degree equivalent to a [UK 2:1 honours degree](#).
 - Ph.D. programmes usually require students to have a Master's degree for Ph.D. eligibility. A research-oriented Master's degree is preferred.
- **For Canada:**
 - For Master's programmes, students may be required to have a 4-year undergraduate degree in Electrical Engineering or a closely related Applied Science field.
 - Applicants to the Doctoral programme should have a thesis-based Master's degree in Electrical Engineering. Furthermore, a bachelor's degree in Electrical Engineering or a closely related field (especially computer and software engineering) is also highly encouraged.
- **For the US:**
 - Students are highly encouraged to pursue an undergraduate degree in Electrical Engineering for Master's admissions but universities may consider students in closely related fields (other branches of engineering, mathematics, computer science, physics, etc.) for admission,
 - Ph.D. programmes usually do require a Master's degree in Electrical Engineering. However, some universities may offer admissions to students that hold an appropriate bachelor's degree in engineering into their MS leading to a Ph.D. programme.
- **For Germany:**

- For Master's admission, an undergraduate degree in Electrical Engineering, Information Technology, or other related fields may be required.
- For Ph.D. admissions, the minimum requirement for admission is a Master's degree in Electrical Engineering (usually a master's degree that includes a research-oriented master's thesis). The Master's degree should be equivalent to a German academic degree that qualifies to start a doctorate.
- **For Turkey:**
 - For Master's admission, applicants may be required to have an undergraduate degree in Electrical and Electronics Engineering, or in a related field of science or engineering. Students with an undergraduate background in areas other than Electrics and Electronics engineering may be requested to take several undergraduate courses in the field to acquire the necessary background.
 - For Ph.D. admissions, applicants are required to have a bachelor's degree in electrical and electronics engineering, or in a related field of science or engineering and a Master's degree is generally not a requirement. However, due to the highly competitive nature of the admission process, students are recommended to pursue a Master's in Electrical Engineering before applying for Ph.D. admissions.

Are there any Coursework requirements?

Note: Coursework requirements for graduate study are the reason why early planning is important for graduate school in Electrical Engineering -- because many courses may have prerequisites, and it may take 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 can be 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.

- **Electrical Engineering related courses:**

- Introductory programming Course
- Electricity and Magnetism
- Mechanics
- Digital Logic Circuits
- Circuits
- Engineering Models
- Signals and Systems
- Microcontroller and Interfacing
- Electromagnetic Fields and Waves
- Electricity and Magnetism
- Devices and Electronics
- Electromechanical Systems
- Feedback Control Systems
- Communication Systems
- Microelectronic Design

- **Computer Science related courses:**

- Introduction to programming
- Computational Problem Solving
- programming Languages
- Databases
- Data Structures and Analysis of Algorithms
- Artificial Intelligence

- **Mathematics related Courses:**

- Calculus (differentiation and integration)
- Calculus II (application of integration and differential equations)
- Linear algebra (vectors and multi-dimensional matrices)
- Discrete mathematics and mathematical reasoning (e.g. induction and reasoning, graph-theoretic models, proofs)
- Statistics and Probability (concepts in discrete and continuous probabilities, Markov chains, etc.)

For Top-Tier programmes

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

- **Most top-tier programmes will expect that students have A's in their Electrical Engineering, Physics, Math, and other Computer Science-related 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 quantitative classes but also 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 type of electrical engineering 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 researching robotics, then they should have taken courses such as robotics dynamics and control, robot motion planning, deep learning, etc.

Are there any GPA requirements?

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

Also notes: Requirements vary according to country and programme -- it is recommended that students contact their prospective programmes and check the requirements of their shortlisted programmes. For more tips on coursework and GPA, check out these [general tips \(under the tab of 'Transcripts'\)](#)

General Information

Generally speaking, GPA is the single most important factor which enables one to get noticed in the eyes of admission committees.

- **For Masters:**

Note: Generally, an undergraduate CGPA greater than 2.8+ 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 3.0+ 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 in a discipline directly relevant to Electrical Engineering Ph.D., 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 3.6+ is strongly recommended.
- **For Canada:** An undergraduate GPA of 3.3+ 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 direct admission, 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 3.6+ along with an honours Master's degree in Electrical Engineering.
- **For the UK:** An undergraduate GPA of 3.7+ and a Master's at merit level or above in Electrical Engineering or a closely related field.

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 Electrical Engineering or a related field:** Students are generally expected to have an undergraduate degree in Electrical Engineering. If you have a more non-traditional academic background, you should still have strong evidence of a sophisticated grasp of Electrical Engineering concepts. For example, through relevant work experience or involvement in academic/individual research projects with a substantial electronics/computer science 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, high GRE score, 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:**
 - Contact the programme 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 of the courses mentioned above and do well in them, make good relations with top-level relevant faculty, obtain strong letters of recommendation, get more research and/or relevant 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 along with research-oriented professional experiences with well-known organisations/research institutes or well-known employers/researchers, to show that you are capable for research work in your graduate studies despite your low GPA.
 - Write a strong personal statement in which you highlight, 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 [Electrical Engineering faculty](#) for graduate programme guidance, letters of recommendation, and other graduate studies application tips.
- It would also be helpful to reach out to possible Mathematics/Physics/Chemical Engineering/Computer Science/programming specialists in the other [SBASSE departments](#), 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 Electrical Engineering or a related degree and are often aspiring for Ph.D. programmes in Electrical 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.
- **Students can participate in research projects every summer.** If summer research is not offered, students should directly approach professors/current graduate students and ask if they can help with their research work.
- **Students planning on pursuing a Ph.D. can find undergraduate research experiences good to have.** However, students should plan on pursuing research in their Master's degree. Since the doctoral degree is highly research-oriented, students should try to align their research interests and experiences with the areas of funded research in the department of interest. Therefore, admission decisions can often be dependent upon finding a faculty member(s) with funded research in a shared area(s) of interest.
- 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?

- **Work experience is not required and is usually irrelevant for both Masters and 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 the personal statement.

Are there any Extracurricular Experience requirements?

- **Extracurricular experiences are not required for both Masters and Ph.D. programmes.** Having extracurricular experiences does not harm a student's application but does not add much value either. However, extracurricular experiences such as relevant student clubs and societies and engineering-related competitions can be a good place to network with other students who are interested in pursuing further studies in electrical engineering, alumni that have a graduate degree in electrical engineering, and relevant faculty.
- Furthermore, these experiences do carry some value if they play a role in developing relevant skills related to the degree (coding, maths, physics, engineering concepts, writing, research, etc.) and in showing how well-rounded the applicant is. They can thus be considered good-to-have but not something to sell in personal statements or potential interviews.

What does this mean for LUMS Students?

- **LUMS students should reach out to [Electrical Engineering 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 Electrical Engineering](#) by Mc Cormick Northwestern Engineering
- [Electrical Engineering - MS, Ph.D.](#) for a classic electrical engineering programme.
- [Is a Master's in Electrical Engineering worth it?](#)
- [Masters in Electrical Engineering programme Admission Guide](#)
- [Typical classes in Master's Electrical Engineering programme](#)
- [Research Areas in Electrical Engineering](#)
- [Guide to earning Ph.D. in Electrical Engineering](#)
- [Tips for writing your Electrical Engineering Personal Statement](#)

Online Resources Consulted

- [Top Electrical Engineering programmes in the US](#)
- [Doctoral programmes in the US](#)
- [Top Electrical Engineering programmes in the UK](#)
- [Tips for writing your Electrical Engineering Personal Statement](#)

Contributors

- Dr. Muhammad Tahir (Assistant Professor; LUMS)
- Dr. Abubakr Muhammad (Associate Professor; LUMS)
- Dr. Ijaz Naqvi (Associate Professor; LUMS)