LUMS
A Not-for-Profit University

Learning Without Borders

SYED BABAR ALI SCHOOL OF SCIENCE AND ENGINEERING

MS & PhD

BIOLOGY

FALL 2021

IMPACT THE WORLD WITH

RESEARCH & INNOVATION

CREATING IMPACT THROUGH RESEARCH

6

DISCIPLINES:

- **BIOLOGY**
- **CHEMISTRY**
- **COMPUTER SCIENCE**
- **ELECTRICAL ENGINEERING**
- **MATHEMATICS**
- **PHYSICS**

For over a decade, the Syed Babar Ali School of Science and Engineering (SBASSE) at LUMS has been imparting top-quality education with an aim to produce future leaders that can make innovative and impactful contributions to science and technology—a key to the success of any nation.

SBASSE offers undergraduate, graduate and doctoral degrees in a wide range of disciplines. The MS programmes at SBASSE are rigorous and designed to impart specialised professional and research-oriented training to students. To graduate, students must accumulate a total of 30 credit hours either entirely from coursework, or by collecting 24 credit hours from coursework and 6 from research work/thesis. Hence, all SBASSE departments offer two options to choose from: MS-by-Coursework or MS-by-Thesis.

The SBASSE PhD programmes prepare students to think scientifically and conduct high-quality research independently. To graduate, students must earn a total of 42 credit hours from which 18 must be from coursework and 24 from research work/thesis. Major milestones that must be achieved for the successful completion of the PhD degree include the Comprehensive (Qualifying) Examination, Thesis Proposal Defense, at least one peer-reviewed journal article and PhD Thesis Defense.

During the course of study, student learning takes place through lectures, tutorials, laboratories, problem-solving exercises, research projects and frequent interaction with experienced and world-class faculty members.

WHY CHOOSE SBASSE

MULTIDISCIPLINARY EDUCATION

The rigorous curriculum of the graduate programmes at SBASSE offers a multidisciplinary learning environment. It provides students with the opportunity to work with knowledge drawn from all six disciplines being offered at SBASSE as a part of the free elective requirement.

LEARNING WITHOUT BORDERS

Research and teaching at LUMS truly offers its community 'Learning Without Borders' by breaking academic, geographic and socio-economic barriers to make education accessible to all. The University continues to be an intellectual hub, rich with varying perspectives and transformative ideas. With an environment brimming with inclusion, unity, and boundless knowledge, learning continues in and beyond the campus walls with the aim to develop innovators, leaders and change-makers who can contribute to the community and build strong borderless networks.

INTERNATIONAL AND NATIONAL EXCHANGE PROGRAMMES

MS and PhD students at SBASSE participate in various exchange programmes and research opportunities sponsored by National ICT R&D Fund, HEC, Commonwealth, Erasmus-Mundus, DAAD etc.

85+ HIGHLY QUALIFIED FACULTY MEMBERS

TOP-QUALITY PUBLICATIONS

We involve our graduate students in impactful research. Their work has been published in top-quality, renowned journals including:

- Journal of Mathematical Analysis and Applications
- IEEE/ACM Transactions on Networking
- Artificial Intelligence Review
- Photonics and Nanostructures: Fundamentals and Applications
- Organic Letters
- The Journal of Biological Macromolecules
- Nature
- Royal Society of Chemistry
- Journal of Computational and Applied Mathematics
- PlosOne
- Stem Cell Research and Therapy
- ACS Synthetic Biology
- Epigenetics and Chromatin

OUR PLACEMENTS

- Top academic placements (Massachusetts Institute of Technology, Harvard University, University of Warwick, London School of Economics, University of Oxford, University of Cambridge etc.)
- Our graduates are hired by top local and international organisations (Engro Corporation, Nestle Pakistan, Systems Ltd., Microsoft, Google, Facebook etc.)
- MS and PhD students work alongside faculty members at SBASSE as Teaching Assistants and Research Assistants.

COLLABORATIONS WITH NATIONAL AND INTERNATIONAL INSTITUTES

- Dr. Utz Fischr, University of Wuerzburg, Germany
- Dr. Marc Windisch, Institut Pasteur, Korea
- Dr. Carole Bewley, National Institutes of Health, USA
- Dr. Thomas Peters, University of Luebeck, Germany
- Dr. Christoph Radamacher, Max Planck Institute of Colloids and Interfaces Potsdam, Germany
- Dr. Fahad Saeed, Florida International University, USA
- Dr. Mehboob Ahmad, Department of Microbiology and Molecular Genetics, University of the Punjab, Pakistan
- Dr. Yousuf Haroon, Shalamar Hospital, Lahore
- Dr. Muhammad Saeed, Department of Chemistry, LUMS
- Dr. Aliya Rehman, University of Karachi, Pakistan
- Dr. Hammad Naveed, FAST University, Pakistan
- University of Oxford, UK
- Atta-ur-Rahman School of Applied Biosciences (ASAB), NUST, Pakistan
- Sheffield Hallam University, UK
- Leibniz Institute of Plant Biochemistry, Germany
- Dr. Altaf Ahmad, Pakistan Kidney and Liver Institute, Pakistan
- Dr. Rozina Arshad, Shalamar Hospital, Pakistan
- Dr. Sajid Soofi, Department of Pediatrics and Community Medicine, Aga Khan University, Pakistan
- Dr. Zarfishan Tahir, Dean, Institute of Public Health, Pakistan
- Maj Gen. Prof Aamir Ikram, Chief National Institue of Health, Pakistan
- Dr. Stephen Bentely, Wellcome Sanger Centre, Cambridge University, UK
- Dr. Athar Aziz, Salford University, UK
- Dr. Shen-An Hwang, Myraid Genetics Molecular Diagnostic Company, USA
- Dr. Jeffry Actor, McGovern School of Medicine, UT Health Houston, USA
- Dr. Charles Darkho, School of Public Health, University of Texas, Health Science Center, USA
- Dr. Jennifer Salinas, School of Public Health, UT Health El-Paso, USA

MS | PhD BIOLOGY

HOW WILL YOU LAUNCH YOUR NEW WORLD?

The Department of Biology offers MS and PhD programmes with specialisations in Molecular Biology and Bioinformatics. State-of-the-art research labs, experienced faculty and a collaborative environment, provide a competitive edge. The Department offers research opportunities in diverse areas of biology including Cancer Therapeutics, Plant Nutrition, Structural Biology related to Viruses, Bacterial Pathogenesis and Diabetes, Epigenetics, Genome Evolution, Bioinformatics, and Virology. The lectures and tutorials are backed by experiments and project work in the laboratories.

QUICK FACTS

- 76.3% UNDERGRADUATE STUDENT PLACEMENT & 23.7% GRADUATE PLACEMENT IN WORLD RECOGNISED INSTITUTIONS
- 9 PHD FACULTY MEMBERS AT THE BIOLOGY DEPARTMENT

WHAT WILL YOUR NEW WORLD INVENT?

Research is at the core of the Biology graduate programmes. In this context, graduate students in Biology are exposed to advanced courses in a wide range of research areas and provided training in different research methodologies. For their research, students can opt from one of the following research groups in Biology led by individual faculty members:

BIOCHEMISTRY AND STRUCTURAL BIOLOGY
Dr. Syed Shahzad ul Hussan

CELL SIGNALLING AND CANCER THERAPEUTICS
Dr. Amir Faisal

RNA THERAPEUTICS
Dr. Muhammad Afzal

COMPUTATIONAL GENOMICS AND SYSTEMS BIOLOGY
Dr. Aziz Mithani

EPIGENETICS
Dr. Muhammad Tariq

PLANT NUTRITION
Dr. Khurram Bashir

MOLECULAR EPIDEMIOLOGY AND MICROBIOLOGY
Dr. Shaper Mirza

SYSTEMS BIOLOGY PROTEOMICS AND HEALTH INFORMATICS
Dr. Safee Ullah Chaudhary

HOW WILL BIOLOGY HELP YOU REALISE YOUR AMBITION?

The Department houses the following research facilities:

- State-of-the-art equipment including confocal microscope, fluorescence-activated cell sorter, fast protein liquid chromatography, MiSeq Next Generation Sequencer, conventional and real-time thermo-cyclers, ultrasonic bioruptor, gel documentation systems, high-speed centrifuges, liquid reagent dispensers, tissue culture facilities and access to high resolution 600 MHz NMR
- A dedicated facility for high-performance computing (HPC) housed within the Bioinformatics Research Laboratory
- HPC nodes as well as General Purpose Graphical Processing Units (GPGPU), including NVIDIA's Grid K2 and Tesla K40C are available at the Lab
- Several in-house software tools available online to leverage the Lab's GPGPUs and HPCs
- Specialised laboratories established for using Arabidopsis, fruit flies and mammalian cells as model systems.

EMBRACE THE BIOLOGY EXPERIENCE

- Dr. Shahzad ul Hussan and Dr. Safee Ullah Chaudhary have won the Shahid Hussain Foundation Research grants 2020 each worth PKR 1 million.
- Dr. Shaper Mirza and her team have been awarded PKR 12 million as a Rapid Research Grant by The World Bank and HEC, to study epidemiological patterns in response to COVID-19 infection.
- Tariq Lab at LUMS discovered over 200 new genes that are involved in the maintenance of cell identities. These results will have a direct implication in the field of cancer biology and regenerative medicine.
- Nida Javed, PhD Biology student of 2016, working under the supervision of Dr. Shaper Mirza, was awarded Best Presenter Award at the International Conference on Medical Microbiology and Infectious Diseases Society of Pakistan held in February 2020 in Lahore. She was also awarded the Indigenous Scholarship to work on the pneumococcal sequence and allele types in strains isolated in the post-vaccine era. She was accepted at the prestigious Wellcome Sanger Centre for Sequencing at Cambridge University, UK for execution of the project. She is also the first author of *'Trends in Antimicrobial Resistance in Strains isolated from blood and Cerebrospinal fluid between 2011-2015'.*
- Anam Farhan, PhD student working with Dr. Shaper Mirza, published an article in collaboration with Ms. Perla Martinez from University of Texas Health Science Center, Rio Grande Valley. The manuscript is the first to demonstrate a role for bacterial protein in evasion of killing by extracellular killing mechanisms deployed by neutrophils. The work was published in *Microbial Pathogenesis.*
- Dr. Rahim Ullah, who completed his PhD in Dr. Amir Faisal's Lab discovered several genes involved in the differentiation of trophoblast stem cells into trophoblast giant cells through genome-wide transcriptomic analysis. The differentiation of trophoblast stem cells is a key event during placental development. The work was published in *Stem Cell Research and Therapy.*
- Two PhD students, Munazza Shahid and Amina Qadir, under the supervision of Dr. Shahzad ul Hussan, engineered a protein that potently inhibits HIV and Hepatitis C virus, representing potential drug candidate for treating co-infections of these two viruses. This work was recently published in the journal, *Viruses.*
- Hafsa Iftikhar, PhD student along with Nayyer Ali, MS student identified potential drugs against SARS-CoV-2 by targeting three key enzymes of the virus using artificial intelligence tools. This work was recently published in *Computer in Biology and Medicine Journal.*
- Amina Qadir, a PhD student of Dr. Shahzad ul Hussan won the prestigious Syed Babar Ali Research Award.
- Hafiza Sara Akram, MS student working under the supervision of Dr. Amir Faisal did a high throughput screening to identify compounds that induce differentiation of trophoblast stem cells into trophoblast giant cells. Ms. Akram has secured a fully-funded position at Florida State University.
- Rida Zahra, MS student at the Cancer Therapeutics Lab, discovered drugs that overcome multidrug resistance through cell-based high throughput screening. The work was published in *PLOS One.* Ms. Zahra has also secured a fully-funded PhD position at Dresden University.
- All three PhD graduates from the first batch who applied for postdoc positions were hired by top universities/institutes in the US.

DR. MUHAMMAD SABIEH ANWAR

Dean and Professor, Syed Babar Ali School of Science and Engineering

"The graduate programmes in science and engineering at SBASSE, LUMS are poised to make an impact. Our deepest impact as an institution would truly be made by the research that emanates from our graduate education and the research that it propels. We are committed to providing a collegial, rigorous and progressive research milieu that triggers the thirst for knowing more and seeking the truth, and in the process, creating tools, gadgets, machines and ideas that address the human condition and global issues. We promise that our graduate programmes will make you ride through the two extremes of the microcosm and the macrocosm, the ideal and the practical, the abstract and the tangible. Welcome to the Syed Babar Ali School of Science and Engineering!"

MS | PhD BIOLOGY

YOUR JOURNEY BEGINS HERE!

Admission Criteria for Local and International Students

Applicants must meet the minimum eligibility criteria in order to be considered for admission to the Graduate Programmes.

MS Programme

Admission is purely merit-based and rests solely on the following criteria:

- Academic Record
- Performance in Admission Tests*
- Application Review
- Interview Performance (If shortlisted)
- Submission of complete online application, application processing fee and online supporting documents by the stipulated deadline

PhD Programme

- Academic Record
- Performance in Admission Tests*
- Application Review
- Research Statement
- Submission of complete online application, application processing fee and online supporting documents by the stipulated deadline
- Interview Performance (If shortlisted)

Note:

This is the minimum criteria that applicants need to fulfil in order to be eligible to apply. Fulfilment of this criteria does not guarantee admission to LUMS.

*We are aware that the current COVID-19 crisis poses difficulties for applicants to submit GRE test scores. Under the circumstances, you may apply to the MS/PhD Biology Programme without the test scores being submitted (if you have not taken the test yet). You may submit your applications without the GRE scores provided all other application components are complete upon submission.
If no GRE is scheduled due to the closure of test centres by March 30, 2021, LUMS will process applications using the available information. If shortlisted, you may then be asked to appear for an interview followed by a conditional acceptance if you are successful. Once, test centres are functioning, you will need to sit for the test and attain the minimum test score required by the University.

Performance in Admission Tests

Applicants to the MS/PhD Programme in Biology are required to take the **LUMS Graduate Admission Test (LGAT)**, which is comprised of quantitative, verbal, and analytical sections. In addition, applicants are required to take the **SBASSE Subject Test** in Biology.

DR. AMIR FAISAL

Associate Professor and Chair, Department of Biology

"The Department of Biology aims to achieve excellence in teaching and research by imparting high-quality, interdisciplinary education to its students augmented by cutting-edge basic as well as translational research. With numerous research opportunities and state-of-the-art laboratory facilities, the Department offers its students an academically rich and intellectually stimulating environment. Experienced and internationally recognised faculty members are working in diverse but overlapping research areas including Epigenetics and Gene Regulation, Structural Biology of HIV and HCV viruses, Cancer Cell Signalling and Therapeutics, Molecular Epidemiology, Drug Resistance as well as Computational and Systems Biology. The research-active environment and quality-focused approach have resulted in our graduates securing fully-funded PhD positions in some of the best universities around the world, including Harvard, Yale, Cornell, Duke and Oxford, amongst others."

Exemption for Applicants Who Have Taken Graduate Record Examination (GRE) Tests

- Applicants who have taken the **Graduate Record Examination (GRE) General Test** through the Educational Testing Service (ETS), USA during the last two years (i.e. after April 11, 2019) and obtained an aggregate score of **300** in the **quantitative** and **verbal sections may choose** not to take the LGAT.
- Applicants who have taken the **GRE Subject Test in Biology or Biochemistry**, **Cell and Molecular Biology** through ETS, USA during the last two years (i.e. after April 11, 2019) and obtained a score at the 60th percentile or above may choose not to take the SBASSE Subject Test in Biology.

International Applicants

Applicants residing outside Pakistan are required to take the **GRE General Test** as well as the **GRE Subject Test** in Biology or Biochemistry, Cell and Molecular Biology through the Educational Testing Service, ETS USA. For further information, please visit www.ets.org

Note:

LGAT and SBASSE Subject Test Scores will be valid only for one academic year. The LGAT and SBASSE Subject Test scores will be used for application evaluation hence will not be disclosed to the applicants.

International Students

In order to study at LUMS, foreign nationals must obtain a 'Study Visa' from the Pakistani Embassy/Consulate working in their country. The Pakistani Embassy/Consulate will only issue a Study Visa for students' stay at LUMS upon receipt of Higher Education Commission (HEC), Pakistan's 'No Objection Certificate' and clearance from the Ministry of Interior, Pakistan.

For the issuance of Visa, students must submit relevant documents to the LUMS Admissions Office through postal mail/courier service by the stipulated deadline.

For details, please visit **international.lums.edu.pk**

FINANCIAL SUPPORT FOR LOCAL AND INTERNATIONAL STUDENTS

Admission to all LUMS programmes is purely on merit and independent of students' ability to pay the related tuition fees. Once a student has been admitted to a programme, there are several mechanisms in place to provide financial support based on need and merit. All awards are reassessed each academic year based on performance, need, available resources and prevailing University policies. LUMS is committed to providing as much financial assistance as possible within the limits of its available resources. Nevertheless, the University may not be able to meet all requests for financial assistance, and it is strongly recommended that applicants secure as much of their own funding as possible. Several funding opportunities are available to deserving MS and PhD students. These include:

- Merit Scholarships for MS programmes
- Partial tuition fee waivers for all MS Basic Sciences and Mathematics students
- LUMS Interest Free Loan (only for local applicants)
- External Scholarships (support and eligibility for these scholarships vary depending on the donor)
- 100% Scholarships (tuition, registration, admission, and a stipend) for PhD students for 4 years
- HEC Research Grants
- Options to work as Research or Teaching Assistants (subject to availability)

For details, please visit
https://financial-aid.lums.edu.pk/graduate-financial-aid

NAJMA SHAHEEN
PhD Student 2015

"Becoming a part of the epigenetics research group and characterising mechanisms of cell fate determination with only basic knowledge of classical genetics was never an easy task. The Department of Biology provides a platform for people from different backgrounds to take the challenge and learn to discover new things by employing cutting-edge research tools and methodology."

DATES TO REMEMBER

DEADLINE TO APPLY
MARCH 30, 2021
5:00 PM (PKT)

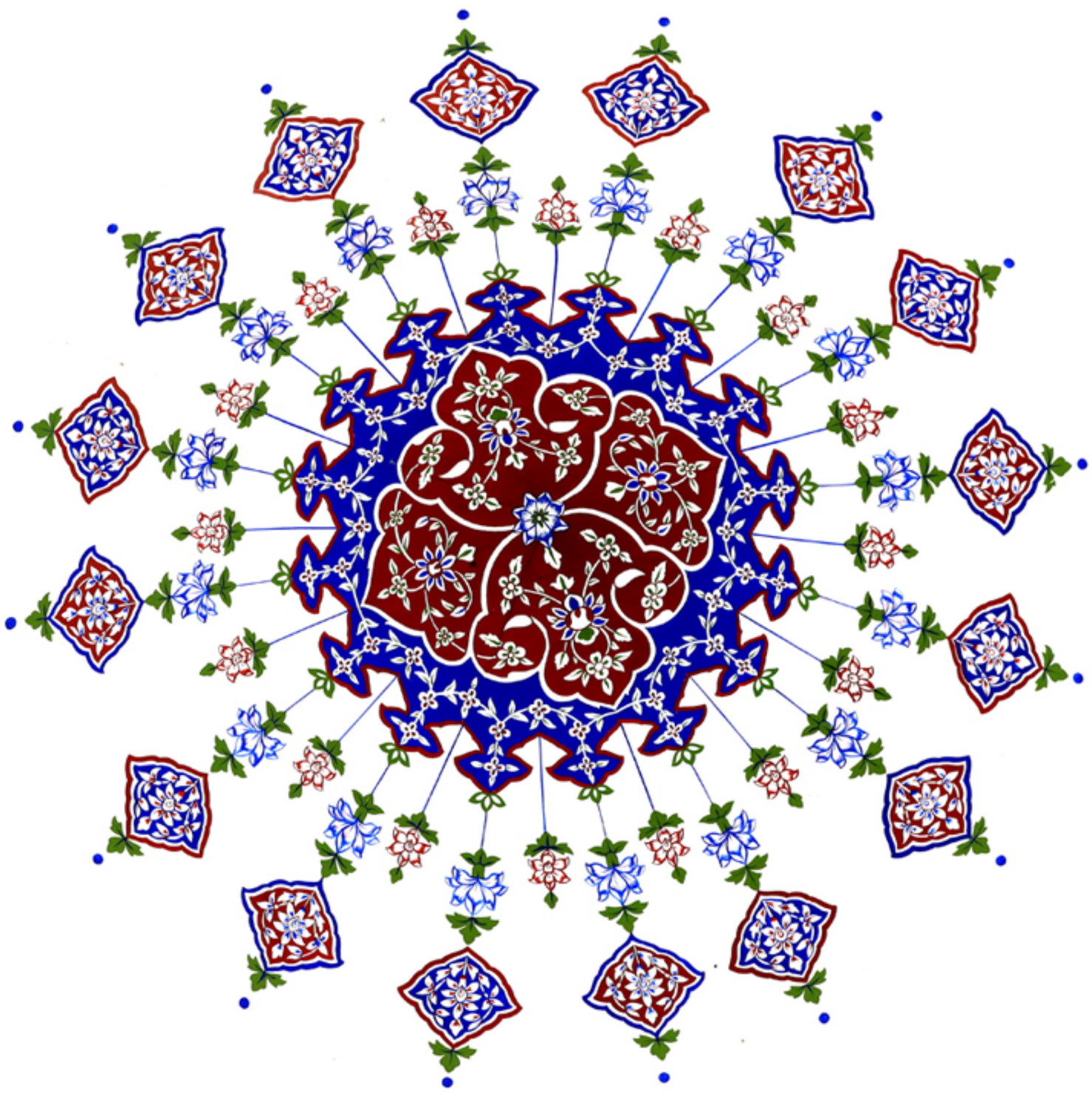
DEADLINE TO SUBMIT ONLINE SUPPORTING DOCUMENTS
APRIL 02, 2021

LGAT & SBASSE SUBJECT TEST
APRIL 11, 2021

DEADLINE TO APPLY FOR LUMS CONTINUING STUDENTS
MARCH 30, 2021
5:00 PM (PKT)

DEADLINE TO TAKE GRE
APRIL 11, 2021

ADMISSION DECISIONS
JUNE 15 - JULY 31, 2021



LUMS

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#MeritMatters