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Syed Babar Ali

School of Science & Engineering (SBASSE)

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Admission Eligibility Guidelines

The Lahore University of Management Sciences (LUMS) is ranked amongst the top 200 universities in Asia by QS World University Rankings. It is one of the top degree awarding institutions in the region, with a strong aim to advance education in a broad range of disciplines including business management, selected areas of sciences and engineering, humanities, social sciences, economics and law. The faculty at LUMS includes 168 PhDs from some of the world's finest institutions including Cambridge, Oxford, MIT, UC-Berkley, Georgia-Tech, Harvard and Stanford.

MS

Biology
Chemistry
Computer Science
Electrical Engineering
Mathematics
Physics

Syed Babar Ali School of Science and Engineering (SBASSE)

Initiated in 2008, SBASSE is the pioneering private research school in Pakistan that imparts top quality education in selected areas of sciences and engineering. It offers 4-year undergraduate programmes in Biology, Chemistry, Computer Science, Electrical Engineering, Mathematics, and Physics that lead to a BS degree. SBASSE also offers MS and PhD programmes in all six disciplines. The School has an excellent infrastructure and state-of-the-art laboratories for conducting research that requires experimentation. Additional information about SBASSE, its academic programmes, research activities as well as its faculty are available at www.lums.edu.pk/sse.

The MS Programme:

MS Programmes at SBASSE are rigorous and designed to challenge incoming 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 the rest from a thesis. Students should note that not all SBASSE departments offer the "MS-by-coursework" option. Typical duration for completing the MS programme is 2 years.

The PHD Programme:

SBASSE PhD programme prepares students to think scientifically and conduct high quality research independently. Students entering the PhD programme must have an MS or MPhil degree. To graduate, students must earn a total of 42 credit hours from which 18 must be from coursework and 24 from research. Students are encouraged to tackle both coursework and research in parallel; success in both these components is a requirement for the award of the PhD degree. Major milestones that must be achieved for the successful completion of the PhD degree include clearing the GRE Subject Test with a score at the 60th percentile or above, comprehensive/qualifying examination, thesis proposal defense, thesis defense and a first-author publication in an indexed journal. Students have 4 years to complete all graduation requirements.

All PhD students admitted to SBASSE are provided full tuition fee waiver and a monthly stipend of PKR 40,000 to cover their living expenses. Continuation of financial support is dependent on satisfactory performance.

PhD

Biology
Chemistry
Computer Science
Electrical Engineering
Mathematics
Physics

Department of Biology

The Department of Biology offers MS and PhD programmes in Molecular Biology. The goal of this programme is to produce knowledgeable and independent researchers who are aware of recent literature and trends in molecular and cell biology, and are also capable of identifying important unanswered questions, designing and carrying out experiments, and analysing experimental data. State-of-the-art research labs, experienced faculty along with a collaborative environment conducive to professional growth and development contribute to the programme's competitive edge.

Research Opportunities

Research is an essential component of any graduate programme. In this context, graduate students of Biology are exposed to advanced courses in a wide range of research areas in Molecular and Cell Biology, Genetics and Epigenetics, Biochemistry and Biophysics, Structural and Computational Biology and subsequently select a research project that is to their liking. Current research projects address fundamental questions in biology including how complex organisms develop from a single cell and how cell fates are determined, how gene expression is regulated in extremophilic microbes, how plants fight disease and develop resistance, how viruses evolve, how drugs and immunoprophylactics are developed against viral infections and in complex diseases such as cancer. Mammalian, Drosophila, plant, bacterial and pseudo-viral systems are employed to answer some of these questions through experimentation and use of computational biological approaches in silico. The department's computational biologists employ mathematical and statistical tools, and develop algorithms to mine large sets of data in order to understand how genomes evolve and how cancer progresses.

Biology labs are equipped with equipment that include confocal microscope, fluorescence activated cell sorters (FACS), Fast Protein Liquid Chromatography (FPLC) apparatus, conventional and real-time thermocyclers, ultrasonic bioruptor, gel documentation system, electrophoresis equipment, temperature-controlled water-baths, shakers, and incubators, high-speed centrifuges, cell and tissue culture rooms as well as facility for growing plants. A walk-in cold room is also available for protein purification and storage. In addition, the Department also has a computational biology laboratory that is fully equipped with computers and essential software that is required for simulating processes and solving various biological problems in silico.

The Faculty

Department of Biology is led by the following members of faculty who are accomplished and experienced in their respective areas of expertise. Additional faculty members are constantly sought to further strengthen and expand the Department's research programmes.

■ **Amir Faisal**
PhD, Friedrich Miescher Institute, Switzerland

■ **Ahmed Jawaad Afzal**
PhD, Southern Illinois University, USA

■ **Aziz Mithani**
PhD, University of Oxford, UK

■ **Muhammad Tariq**
PhD, Friedrich Miescher Institute, Switzerland

■ **Sadia Hamera**
PhD, Chinese Academy of Sciences, China

■ **Saima Anwar**
PhD, University of the Punjab, Pakistan

■ **Safee Ullah Chaudhary**
PhD, Korean Advanced Institute of Science and Technology, South Korea

■ **Shaper Mirza**
PhD, University of Alabama at Birmingham, USA

■ **Sohail A. Qureshi**
PhD, University of Maine, USA

■ **Syed Shahzad ul Hussan**
PhD, University of Luebeck, Germany

Research programmes led by the Biology faculty members are listed below.

Biology of Hepatitis-C Virus; Regulation of Gene Expression in Thermophilic Archaea **Dr. Sohail A. Qureshi**

Hepatitis-C viral (HCV) infections reduce the quality of life for over 170 million people worldwide. Although HCV was discovered about 21 years ago, the available treatment options for infected individuals are limited. Despite much effort, development of vaccines and drugs against HCV has been hampered due to rapid evolution of the virus. Dr. Qureshi's group is interested in studying the basic biology of HCV and in particular to understand how HCV encoded proteins influence the transcriptome, proteome and epigenome of infected hepatocytes during the different stages of infection. Additionally, conserved regions within the HCV genome are being identified that may serve as useful vaccine candidates.

Archaea represent a highly diverse class of prokaryotic microorganisms capable of withstanding harsh environmental conditions such as extremes of temperature, pH, salinity and pressure. Using *Sulfolobus* as a model organism, Dr. Qureshi's group is studying mechanisms through which heat shock, DNA damage and oxidative stress are induced. The goal is to identify factors that sense such stresses and to understand how they interact with the various components of transcription machinery to influence expression of their respective target genes.

Epigenetics **Dr. Muhammad Tariq**

The epigenetics laboratory at SBASSE utilises fruit fly (*Drosophila melanogaster*) as a model system to understand role of Polycomb and Trithorax group proteins, which are known to play pivotal roles in maintenance of cell memory. Polycomb group proteins (PcG) maintain genes in a silent (inactive) state whereas Trithorax group proteins (TrxG) act as anti-silencers. Goals of the various ongoing projects are to understand at the molecular level how cell signaling is linked to maintenance cell memory by PcG and TrxG, and how these factors may play a role in transgenerational inheritance of epigenetic states of gene expression.

Computational Systems Biology **Dr. Aziz Mithani**

The focus of Computational Systems Biology group is to develop and apply computational and mathematical methods to understand how biological systems function and evolve with time. Specifically, such approaches are being employed to decipher the genetics of bread wheat and understand the type and number of hybridisation events through which modern day bread wheat has evolved from different goat grasses and Eikorn (pasta wheat). This project is being carried out in collaboration with Harberd Laboratory at the Department of Plant Sciences, University of Oxford, and uses the latest technologies in genomic sciences including high-throughput sequencing and associated statistical analysis to determine the precise nature and extent of genetic variation that has led to the modern day bread wheat. the process of cell memory.



Cell Signalling and Epigenetics

Dr. Saima Anwar

Different cells in the body respond to a variety of intrinsic as well as extrinsic signals during normal development as well as pathological conditions by altering their gene expression profiles or patterns. The dual roles Polycomb Group of proteins (PcGs) play in maintaining cellular fate as well as its transition signifies the dynamic nature of cell memory. The laboratory aims to understand the role of PcGs in this process, and how PcGs and TrxGs mediated gene regulation is impacted by signalling cascades that are triggered by environmental factors including stress.



Biomedical Informatics

Dr. Saeef Ullah Chaudhary

An integrative analysis of biological and clinical data can help researchers develop a deeper appreciation of the principles underpinning life. Towards this goal, the group constructs integrative models of complex pathologies such as cancer to as far as building decision support systems for conditions such as pregnancy. The current research focuses include multi-scale investigation of the human colon cancer, integrative modelling of cellular bioenergetics, development of a next-generation cancer modelling platform, top-down proteomics and remote e-health monitoring systems.



Structural Biology Laboratory

Dr. Syed Shahzad ul Hussan

Employing cell culture, biochemical methods, and nuclear magnetic resonance (NMR) based structural biology approaches, this group focuses on the following areas: 1. Probing structural and conformational properties of antibody target sites (epitopes) on envelope glycoproteins of hepatitis C virus (HCV). 2. Identification of new HCV neutralising antibodies from sera of chronically infected patients. 3. Identification and engineering of HIV and HCV cellular entry inhibitor lectins and understanding their basis of blocking viral adhesion and entry by NMR spectroscopy.

RNA Silencing and Host-pathogen Interactions

Dr. Sadia Hamera

RNA silencing is a regulatory process that controls gene expression at transcription (TGS) and post-transcription (PTGS) levels. In TGS, RISC proteins AGO4/6 recruit siRNAs to maintain the epigenetic blueprints of repeat associated loci, transposons and silence exogenous nucleic acids through methylation. Plants take advantage of this silencing machinery for defense against pathogens. As an anti-host defense, pathogens in turn encode suppressor/effector proteins that block RNA silencing responses in hosts. The main focus of RNA silencing group is to decipher the roles of various components (and identify new ones if necessary) that are involved in plant innate immunity. Given that a large number of Pakistani crops are destroyed by pathogens, the major goal of this work is to improve the environmental fitness of economically important crops by enhancing their resistance against various pathogens.

Cancer Therapeutics

Dr. Amir Faisal

The promise of targeted or personalised treatments for cancer in a post-genomic era has been highlighted by the success of several drugs that target particular driving mutations in different types of cancer. The cancer therapeutics group at SBASSE is currently focused on the following: 1. Determining the mechanism of action of drugs that target proteins involved in cancer, including Aurora family of mitotic kinases. 2. Understanding the underlying mechanisms through which cells “learn” to become resistant to various drugs. 3. Identification of naturally occurring compounds for treating cancer (in collaboration with Department of Chemistry). The group also aims to identify novel drug targets using synthetic lethal screens.

Department of Chemistry

The Chemistry Department aspires to establish itself as an internationally recognised and globally competitive centre for graduate teaching and research. The Department has initiated and maintained internationally recognised research programmes in a wide variety of chemical disciplines for the last few years that include nanoscience and nanotechnology, materials chemistry, catalysis and drug discovery. The faculty consists of an outstanding group of scientists who are committed to pursuing and maintaining excellence in research.

The graduate programme (MS and PhD) in Chemistry is an exciting opportunity for students to take advantage of the Department's conducive and thriving research environment to contribute effectively in the development of science. The Department's mission is to produce outstanding graduates who can excel and become future leaders in academia and industry.

The Faculty

The Chemistry faculty is committed to achieving excellence in teaching and develop world-class research programmes especially at the interface of Chemistry and other science and engineering disciplines. Given below is the list of currently available faculty and their research areas:

- **Ghayoor Abbas**
PhD, Michigan State University, USA
- **Salman Noshear Arshad**
PhD, University of Illinois at Urbana-Champaign, USA
- **Irshad Hussain**
PhD, University of Liverpool, UK
- **Habib-ur-Rehman**
PhD, Institute for New Materials, Saarbrucken, Germany
- **Muhammad Saeed**
PhD, University of Tübingen University, Germany
- **Rahman S. Z. Saleem**
PhD, Michigan State University, USA
- **Falak Sher**
PhD, University of Cambridge, UK
- **Basit Yameen (Adjunct faculty)**
PhD, Max Plank Institute for Polymer Research, Mainz, Germany
- **Muhammad Zaheer**
PhD, University of Bayreuth, Germany

Research Areas

The Department of Chemistry at LUMS is comprised of a diverse group of research-active faculty members. In addition to the traditional areas of chemical sciences, they work on interdisciplinary research projects interfacing chemistry with various fields, including Biology, Medicine, Physics, Environmental and Material Science and Engineering. The following faculty research groups are actively working to develop world-class research programmes in Nanoscience and Nanotechnology, Macromolecular Chemistry, Green Synthesis/Catalysis, Renewable Energy Technologies, Drug Discovery, Healthcare and Environmental Remediation.

Catalysis and Green Chemistry

Dr. Ghayoor Abbas

This group is interested in designing novel green synthetic methodologies for the functionalisation of aromatic hydrocarbons. The newly synthesised organic compounds will have applications in a wide range of areas including pharmaceutical chemistry, polymer chemistry, renewable energy and catalysis and material science.

Nano-engineered Materials

Dr. Salman Nosheer Arshad

This group focuses on the design and synthesis of novel hierarchical and multifunctional nanoscale materials with tunable microstructures and properties. The emphasis is on the low cost and scalable nanoscale materials and their nanocomposites for energy, environment and bio-related applications. Moreover, the group has research interests in in-situ electron microscopy for characterising the mechanical response of materials at nanoscale and how the interfaces can be engineered for maximum performance.

Functional Nanomaterials

Dr. Irshad Hussain

This group focuses on the synthesis of metal/metal oxide nanoparticles/nanoclusters with a fair control over their size, shape and surface chemistry, their use as building blocks to develop new nanostructured materials with controlled nanoscale features and unique properties. These nanomaterials are also being evaluated to explore their potential applications in renewable energy technologies (solar/fuel cells and H₂ production), catalysis, drug/gene delivery, disease diagnostics, sensing, bacterial detection and environmental remediation.

Polymers and Nanocomposites

Dr. Habib-ur-Rehman

This group focuses on the synthesis of low loss optical materials that can be used in micro photolithography for a wide range of applications such as in backplanes, photonics, microfluidics, data communications and telecommunications. In addition, processes are being developed to produce high refractive index materials (hybrids and nanocomposites) and thin films of silica, polymers and metal oxides for applications in photonics and renewable energy technologies.

Synthetic Organic Chemistry and Chemical Biology

Dr. Muhammad Saeed

This group focuses on unraveling molecular mechanistic details of disease development by various endogenous and exogenous factors, and discovering disease specific and pharmaceutically exploitable new targets. Current research involves the investigation of the role of estrogen metabolism in the development of breast and prostate cancers, and discovering/synthesising new organic compounds for pharmaceutical intervention. Additionally, the group is involved in discovering new organic reactions and developing new organometallic compounds in the pursuit of accomplishing total syntheses of biologically active aporphine alkaloids. To accomplish these scientific endeavours, the group exploits techniques of synthetic organic chemistry, chromatographic sciences and chemical biology.

Drug Discovery

Dr. Rahman S. Z. Saleem

This group focuses on the development of next generation drugs and molecules with potential biological applications. The group is especially interested in exploring the chemical space for cancer treatment, in the molecules that can modulate the activity of viruses of the Flaviviridae family, especially HCV and the dengue fever virus and in molecules that can help in the understanding of the mechanism of action of potential inhibitor. Currently, this group is working on the check-point kinase 2 inhibitors, p53 peptidomimetics (both of which are potentially useful targets for therapeutic intervention in cancer treatment) and anti-malarial drugs.

Solid State Chemistry

Dr. Falak Sher

This group focuses on the synthesis of functional inorganic materials such as electronic and magnetic metal oxides by the conventional solid state and sol gel methods, their crystal structures analysis by the powder X-ray diffraction and investigation of other physical properties.

Soft Matter and Interfaces

Dr. Basit Yameen

This group focuses on the design and synthesis of functional bulk and surface tethered polymers, complex macromolecular architecture, stimuli responsive macro and nanoscale (smart) materials, surface functionalisation of nanoparticles, nanoporous materials, and nanocomposites for applications in alternative energy technologies (solar/fuel cells), addressing environmental challenges (remediation and sensing), and engineering materials for biomedical applications (nanomedicine).

Nanocatalysis

Dr. Muhammad Zaheer

This group focuses on the design of robust, active, selective and environmentally benign heterogeneous catalysts for the production of renewable energy, biofuels and biochemicals. Mono/bimetallic nanoparticles are dispersed over highly robust silicon carbide (SiC) and silicon carbonitride (SiCN) supports whose porosity is tuned by the self-assembly of diblock copolymers. The nanoporous catalysts are tested for their potential applications in CO₂-neutral and reversible storage of hydrogen in renewable liquid organic compounds, for instance, glycerol and formic acid.

Research Facilities

Chemistry teaching and research labs are well equipped with the state-of-the-art experimental facilities and equipment. There is a good collection of supplies and equipment including spectroscopic, structural and materials characterisation tools. These tools include field emission scanning electron microscope equipped with transmission detector, EDS and e-beam lithography, GC-MS, XRD (Powder), TGA-DTA, HPLC, Vibrating Sample Magnetometer (VSM), Zetasizer Nano – ZSP, Multi-label Plate reader, FT-IR spectrometer with diamond ATR attachment, FT-IR spectrometer for thin-films analysis, UV-Vis spectrophotometers, spin coater, Differential Scanning Calorimeter (DSC), microwave synthesizer (CEM), refrigerated/non-refrigerated micro-centrifuges, high-temperature furnaces, photo-reactors, pellet press machine, high-temperature autoclave with steel/teflon reactor, impedance analyser with climate chamber attachment, potentiostat with cyclic voltammeter, water contact angle measuring equipment, magnetic susceptibility balance and goniometer etc.

Research Collaborations

The Chemistry faculty has developed very effective and fruitful research collaborations with prominent national and international research groups especially those in USA, UK, Germany, Switzerland, Turkey, China and Saudi Arabia. These collaborations are very helpful in keeping the faculty abreast with the latest developments in the field and to use advanced technology and high-tech equipment that are currently not available anywhere in Pakistan. So far, these collaborations have been very effective to get highly competitive international research grants and to publish high quality research articles in prestigious international journals.

Department of Computer Science

The Department of Computer Science at LUMS boasts fourteen full-time faculty members, with doctorates from some of the best universities in the world. The major research areas in the Department include Computer Vision, Data Mining, Networks and Distributed Systems, Software Engineering, Theory of Computation, Artificial Intelligence and Robotics.

Faculty members of the Department, together with their students, have published their research in renowned conferences and journals in the field. Over the past four years, the Computer Science faculty has published over 140 research papers and sought PKR 160 million in research grants from national and international funding agencies.

Computer Science graduates of LUMS are one of the most sought-after individuals in Academia and Industry both locally and internationally. CS students have had direct placements at companies like Google, Microsoft and Facebook and have received admissions in leading Universities of the world included MIT, Stanford, Harvard and UIUC.

Research

Computer Vision

Computer Vision focuses on the theoretical aspect and the practical applications of machines that can 'see', that is, extract useful information from an image or video, to carry out certain functions or tasks. Current research in the Computer Vision Lab at SBASSE focuses on applications of this field for developing countries. In this context, recent projects include the development of a crawler for Google Earth that allows for segmentation of nucleated villages in satellite imagery, as well as the development of a low-cost ultrasound training simulator that will allow trainee doctors to practice without relying on real patients and innovative ways to map socio-economic parameters for Pakistan.

Data Mining

Data Mining involves extracting informative patterns from large scale data-sets. The rapid growth in this field is fuelled by increasing demand for automated data analysis and the rise in computation power. The CS Department at SBASSE is currently undertaking research in the realm of parallel algorithms for data mining, efficient message protocols and hardware/software performance benchmarking, machine learning and intelligent information processing. The department has two fully equipped labs – Knowledge and Data Engineering Lab and High Performance Computing Lab with hardware and software resources for the development and evaluation of algorithms and computational models for analysis of large structured and semi-structured date-sets.

Networks and Distributed Systems

This research area explores the manner in which computing devices interconnect and the design of innovative computer systems that such interconnection enables. The focus is on the fundamental theory of computer networks and innovative applications of systems especially in the context of the developing world. Areas of research include cloud computing and data centres, mobile and wireless networks, network security, pervasive computing, multimedia communications, access control, data privacy and smart grids. Faculty members working in this area have published their research in the most prestigious conferences and journals including ACM SIGCOMM, IEEE INFOCOM, ACM CoNEXT, ACM IMC, IEEE/ACM Transactions on Networking and ACSAC.

Software Engineering

Software Engineering is the study and application of engineering to the design, development, and maintenance of software. The focus of the research undertaken by the Software Engineering Lab at SBASSE is in the areas of Software Reengineering, Software Testing and Quality Assurance, Software Engineering for Smart Grids, Formal Verification and Validation, Software Architectures for e-Government initiatives, and Software Engineering for Healthcare Systems. The research output of the Software Engineering group has been published at various top international conferences and journals like ICSE, ICSM, OOPSLA, TSE, TSG, SASO, and ASE, among others in recent years.

Algorithms and Theory of Computation

Theory of Computation is the formal study of the power as well as limits of computing machines. This is accomplished by the design of efficient algorithms as well as proofs of intractability for various computational problems. Theoretical computer science includes sub-areas such as Graph Theory and Algorithms, Randomised Algorithms, Data Structures, Complexity Theory, Computational Biology, Computational Geometry, Cryptography, Computational Learning Theory and Coding Theory.

Artificial Intelligence and Robotics

Artificial Intelligence and Robotics research at LUMS is primarily focused on Applied Soft Computing, with CS Department contributions to the fields of Intelligent Speech and Natural Language Processing, Intelligent System Modelling, Simulation and Controls, Data Mining and Self Rule Generation, Artificial Intelligence, Databases and Aspect Oriented Programming, Neural Networks and Fuzzy Systems, and Robot Design, Planning, and Learning. The Robotics and Intelligent Computing (RICE) lab at SBASSE has also developed two working robots indigenously and plans to develop an automatic assembly line robotic system.

The Faculty

- **Arif Zaman**
PhD, Stanford University, USA
Research Area: Cryptography, Statistics, Theoretical Computer Science
- **Asim Karim**
PhD, Ohio State University, USA
Research Area: Data Mining, Machine Learning
- **Basit Shafiq**
PhD, Purdue University, USA
Research Area: Business Process Management
- **Hamid Abdul Basit**
PhD, National University of Singapore, Singapore
Research Area: Software Maintenance, Software Design
- **Ihsan Ayub Qazi**
PhD, University of Pittsburgh, USA
Research Area: Networks and Distributed Systems
- **Imdadullah Khan**
PhD, Rutgers University, USA
Research Area: Theoretical Computer Science
- **Junaid Haroon Siddique**
PhD, University of Texas at Austin, USA
Research Area: Formal Verification and Validation, Dynamic Analysis
- **Mian Muhammad Awais**
PhD, Imperial College London, UK
Research Area: Artificial Intelligence, Robotics
- **Muhammad Fareed Zafar**
PhD, Duke University, USA
Research Area: Data and Network Security
- **Murtaza Taj**
Queen Mary University, UK
Research Area: Digital Image Processing, Computer Vision
- **Naveed Arshad**
PhD, University of Colorado, USA
Research Area: Software Engineering for Smart Grids, Educational Technologies
- **Shafay Shamail**
PhD, University of Bath, UK
Research Area: E-government Architectures, Software Quality
- **Sohaib Ahmad Khan**
PhD, University of Central Florida, USA
Research Area: Computer Vision
- **Zartash Afzal Uzmi**
PhD, Stanford University, USA
Research Area: Networks and Distributed Systems

Department Of Electrical Engineering

The largest department at LUMS, the Electrical Engineering (EE) Department was established in 2008. It offers a very rigorous and modernised undergraduate programme which is accredited by the Pakistan Engineering Council. Today, the department has about 400 undergraduate and graduate students and 18+ full-time PhD faculty members. The first batch of EE undergraduate students graduated in June 2012 which (along with the subsequent batches) has been a tremendous success both in terms of graduate and job placements. The electrical engineering programme gives students both a strong foundation and specialisation in important contemporary areas of electrical engineering including Communication Systems, Computer Networks, Embedded Systems, Nanoelectronics, VLSI Design Signal Processing, Control Systems, Robotics, Renewable Energy Systems and Optoelectronics. Students are also strongly encouraged to collaborate with other disciplines at SBASSE. The alumni of EE department have been placed in most famous universities around the globe such as UT Austin, Cambridge, EPFL Switzerland, UPenn, TUM Munich, Carnegie Mellon University, RICE University, UIC Chicago, Rutgers, Georgia Tech, USC, NTU Singapore, UCSD, Michigan State University, etc.

The department hosts a growing research active full-time faculty with PhDs from the world's top institutes. The EE faculty is committed to solving important issues pertaining to a wide range of areas. Since its inception, the faculty and their academic staff (most of whom are LUMS graduate students) have published 100+ peer reviewed research articles in the highest ranked international journals published by IEEE, ACM, IET, IEE and IOP and presented their research findings at dozens of top tier conferences in their respective fields. Several of these publications are a direct outcome of MS and PhD thesis work carried out in the department.

Faculty members regularly visit and have maintained research collaborations with several top academic institutes of the world; hosted professors and students from institutes within Pakistan and abroad; organised workshops, conferences and seminars both locally and at the international level.

Structured into various research clusters and labs, the department has collaborated and obtained funding from local and international industry including the likes of National Instruments, Mentor Graphics and Mitsubishi. It has also secured competitive grants from agencies including Higher Education Commission (HEC), National ICT R&D Fund and German Academic Exchange (DAAD). Some faculty members have served as consultants and collaborators for several government agencies and non-government research organisations including the Punjab Environmental Protection Agency (EPA), Punjab Irrigation Department (PID), Cleaner Production Institute (CPI), World Wildlife Fund (WWF) and International Water Management Institute (IWMI).

The Faculty

- **Abubakr Muhammad**
PhD, Georgia Institute of Technology, USA
- **Farasat Munir**
PhD, Georgia Institute of Technology, USA
- **Hassan Abbas Khan**
PhD, University of Manchester, UK
- **Ijaz Haider Naqvi**
PhD, IETR-INSA, Rennes, France
- **Jahangir Ikram**
PhD, University of Manchester, UK
- **Muhammad Adeel Pasha**
PhD, University of Rennes-1, France
- **Muhammad Tahir**
PhD, Politecnico di Torino, Italy
- **Momin Ayub Uppal**
PhD, Texas A&M University, USA
- **Nadeem Ahmed Khan**
PhD, Eindhoven University of Technology, Netherlands
- **Nauman Ahmad Zaffar**
MS, University of Pennsylvania, USA
- **Nauman Zafar Butt**
PhD, Purdue University, USA
- **Naveed Ul Hassan**
PhD, SUPELEC, Gif-sur-Yvette, France
- **Shahid Masud**
PhD, Queen's University, Belfast, UK
- **Syed Azer Reza**
PhD, University of Central Florida, USA
- **Tariq Mahmood Jadoon**
PhD, University of Strathclyde, UK
- **Waqas Majeed**
PhD, Georgia Institute of Technology, USA
- **Wasif Tanveer Khan**
PhD, Georgia Institute of Technology, USA
- **Zartash Afzal Uzmi**
PhD, Stanford University, USA

EE Research Clusters

Advanced Communications Laboratory (AdCom)

Director: Dr. Momin Uppal

Associated Faculty: Dr. Ijaz Haider Naqvi, Dr. Naveed Ul Hassan

<http://adcom.lums.edu.pk/>

The AdCom lab carries out research in many diverse aspects of modern-day telecommunication systems; the main themes include Modelling, Design, Simulation, Implementation and Performance Characterisations. The lab's research spans many diverse aspects of modern-day telecommunication systems such as cross layer optimisation and networking problems in wireless systems (LTE/LTE-A), event detection and identification in wireless sensor networks, efficient strategies for cognitive cooperative communication, experimental implementation of relaying platforms, performance analysis of ultra wideband systems, applied signal processing, as well as scheduling algorithms, demand response management, demand shaping and integration of renewable energy sources in smart grids. During the last three years the lab has been accorded international recognition through the acceptance of 44 research publications at prestigious peer-reviewed journals and conferences. Additionally, two patents were granted and two were submitted; one of those patent applications also got published recently.

Laboratory for Cyber Physical Networks & Systems (CYPHYNETS)

Director: Dr. Abubakr Muhammad

<http://cyphynets.lums.edu.pk/>

Research conducted at CYPHYNETS pertains to Systems Engineering, Applied Mathematics and Robotics. The overall aim is the development of Cyber-Physical Systems (CPS) for welfare, environment and sustainable development. One of the main research thrusts is control, estimation and optimisation of water resources in Pakistan. The other major research thrust is theoretical and experimental research in various areas of robotics. The lab is self-sufficient to develop its own robot platforms including mechanical design, mechatronics, control, perception, software and algorithms. The focus is on developing unmanned ground vehicles for humanitarian applications such as landmine clearance and agriculture, in line with the lab's goal of developing cyber-physical systems for development.

Signal, Image and Video Processing Lab

Director: Dr. Nadeem Khan

Associated Faculty: Dr. Waqas Majeed, Dr. Jahangir Ikram, Dr. Muhammad Tahir

<http://lums.edu.pk/cluster/signal-image-and-video-processing-lab>

The Signal, Image and Video Processing lab conducts research in the area of Video Processing, Computer Vision and Signal Processing. Current areas of interest include Activity Analysis and Recognition, Multi-view video (occlusion detection, view synthesis), Distributed Video Coding, Scalable and Multiple Descriptive approaches for heterogeneous terminals and networks, Wavelet and DCT transform based, Compression techniques, Biomedical Signal/Image Processing and Classification. The past and ongoing project activities also include work on complexity scalable and power-aware video codecs, fast but high performance motion estimation techniques, Proprietary DCT and Wavelet based real-time video codecs for videoconferencing applications and Proprietary real-time audio HVXC codecs. The Lab has housed several senior and Masters projects, Masters thesis and externally and internally funded research and development projects.

Energy and Power Systems Cluster

Director: Dr. Nauman Ahmad Zaffar

Associated Faculty: Dr. Hassan Khan

<http://lums.edu.pk/SBASSE/ee/cluster/energy-and-power-systems>

Research is being conducted on developing models for smart grids and their use in designing smart power distribution infrastructure for developing countries. Work in progress includes generation through renewable energy sources, integration with grid, power flow control, smart homes and smart metering infrastructure development. Detailed analysis on the performance of various kinds of bulk and thin film based solar panels for is also being conducted using various characterisation methods. Modelling and characterisation of high efficiency tandem solar cells using TCAD tool is also being investigated. The group has strong linkages with local and regional industry partners for electrical energy conservation, optimisation and integration of renewables in smart grids along with the development of Smart MicroGrid infrastructure at LUMS.

Electronics and Embedded Systems Cluster

Director: Dr. M. Adeel Pasha

Associated Faculty: Dr. Jahangir Ikram, Dr. Wasif Tanveer Khan, Dr. Farasat Munir, Dr. Shahid Masud

The main focus of this research cluster is to explore customised hardware, software and co-design solutions for embedded systems. The development of high speed programmable DSP chips as well as re-configurable and programmable hardware has made it possible that many operations of conventional high performance and low power applications can be implemented in the form of re-usable Silicon IP-cores and associated software code. This not only reduces design time and cost by orders of magnitude but enables manufacturers to maintain a balanced inventory. Important contemporary applications in which these modern system design techniques are being investigated include software defined radios (SDR) and wireless sensor networks (WSN). Other research activity includes hardware based algorithm acceleration in compute-intensive systems such as multimedia (image/video) applications. In this approach, instead of running the application tasks on a programmable processor, an application specific micro-architecture tailored to the application at hand is generated either by manually written or automatically generated hardware description language (HDL) codes. This approach results in achieving ultra-low-power designs for complex system-on-chip applications.

Devices, Optics and Electromagnetics Cluster

Director: Dr. Syed Azer Reza

Associated Faculty: Dr. Hassan Khan, Dr. Farasat Munir, Dr. Mumtaz Sheikh, Dr. Wasif Tanveer Khan

Research is being conducted on the design of intelligent instrumentation using Opto-electronic sensors and devices. Spectral response modelling, characterisation and analysis of III-V Phototransistors is being conducted for high speed Opto-electronic systems such as Photoreceivers. Other activities include RF Integrated Circuits and Designing of MIMO and UWB antennas in complex operating environment.

Semiconductor and Nanoelectronic Devices (SND) Lab

Director: Dr. Nauman Zafar Butt

Associated Faculty: Dr. Hassan Khan, Dr. Farasat Munir

Research at the SND lab focuses on the device design, physics based modelling, and characterisation in a broad range of semiconductor and nanoelectronic technologies including MOSFETs, on-chip memory cells, solar cells, biological sensors, and, micro-electromechanical systems (MEMS). Computational/theoretical research is based on physics based numerical simulations and analytical modelling with a focus on discovering innovative solutions for emerging technologies. Experimental research focuses on device performance and reliability analysis using nanofabrication and electrical/optical device characterisation. Due to its multidisciplinary nature, SND lab closely collaborates across various departments within SBASSE as well as outside LUMS with other national and international universities. Some of the on-going projects include carbon nanotube based solar cells, III-V phototransistor modelling/characterisation, and biological sensors for Lab-on-a-Chip applications.

Mathematics is both the most fundamental of all the sciences and also the most applicable as it is the rigorous study of structure, relationship and pattern. The Department of Mathematics offers undergraduate, MS and PhD degree programmes. The faculty at the Department of Mathematics works across a wide spectrum of mathematical fields. The Department is dedicated to conducting research work in pure as well as applied mathematics. Some examples of interests within pure mathematics are Functional Analysis, Topology, Fixed Point Theory, Operator Theory, Graph Theory, Combinatorics, and Symmetries of Differential Equations. Areas in applied mathematics include Computational Statistical Mechanics, Numerical Methods, Mathematical and Computational Biology, Stochastic Processes, Epidemiology and Cancer Kinetics.

Faculty

The faculty includes PhDs hailing from some of the world's finest institutions such as Stanford, MIT, Western Ontario, Oxford, Pennsylvania, Aberdeen and Arizona State.

Regular involvement with international conferences and publications keeps the Department of Mathematics faculty abreast of global education trends. Moreover, eminent visiting scholars further diversify and enrich the learning experience.

- **Adnan Khan**
PhD, Rensselaer Polytechnic Institute, USA
- **Arif Zaman**
PhD, Stanford University, USA [joint with Computer Science]
- **Amer Iqbal**
PhD, Massachusetts Institute of Technology, USA [joint with Physics]
- **Faqir Bhatti**
PhD, University of London, UK
- **Hanif Mian**
PhD, University of the Punjab, Pakistan
- **Hira Nadeem**
MSc, Florida Atlantic University, USA
- **Imran Naeem**
PhD, University of Witwatersrand, SA

- **Masood Hussain Shah**
PhD, University of Aberdeen
- **Mujahid Abbas**
PhD, National College of Business Administration and Economics, Pakistan
- **Shamim Arif**
PhD, University of Manchester, UK
Imran Naeem
PhD, University of Witwatersrand, SA
- **Sultan Sial**
PhD, University of Western Ontario, Canada
- **Haniya Azam**
PhD, GC University, Pakistan
- **Amer Rasheed**
PhD, Centre de Mathématiques Appliquées, INSA de Rennes, European University of Bretagne Rennes, France
- **Muhammad Imran Qureshi**
PhD, University of Oxford, UK
- **Kamran Rashid**
MS, University of Wisconsin-Madison, USA
- **Shaheen Nazir**
PhD, GC University, Pakistan
- **Muhammad Ahsan**
PhD, Central European University, Hungary

Centre for Advanced Studies in Mathematics (CASM)

Director: Dr. Faqir Bhatti

The Centre for Advanced Studies in Mathematics (CASM) is one of the leading centres for research in mathematics in Pakistan. In the 21st Century, the role of mathematics in formulating and solving a variety of interdisciplinary problems has been well recognised. The continuing development of the mathematical and computational sciences is fundamental to the scientific progress of Pakistan. The basic activities of CASM are to promote mathematics amongst students and develop human resources in this field.

The Centre's current areas of activity include Functional Analysis, Operator Theory, Mathematical Biology, Scientific Computation, Graph Theory, Enumerative Combinatorics, and Symmetries of Differential Equations. CASM aspires to promote interaction between mathematicians and experts of other disciplines, such as electrical and computer engineering, economics and social sciences. The Centre is actively engaged in conducting research, organising workshops and conferences, arranging short courses and exploring linkages with other disciplines, among other activities.

Centre for High Performance Computing

The Centre for High Performance Computing provides scientific computing facilities for the LUMS research community. The goals of the centre are to engender and facilitate science and engineering research efforts; assist researchers with specialised computational needs and provide research and development exposure to students. The computing facility comprises of an HPC cluster and multiple high end symmetric multiprocessing servers. Currently the centre is catering to the research and course needs of the Departments of EE, CS, Mathematics, Biology, Physics, Economics and the LUMS Suleman Dawood School of Business (SDSB).

Department of Physics

The Department of Physics has an outstanding teaching and research environment. The research focuses on probing fundamental physical aspects of the universe and the underlying mathematical structures as well as novel applications in diverse areas including nanoscience, optics, nanophotonics, quantum dynamics and magnetic materials. An important function of the Department is encouraging students to get involved in research questions and exploratory experiments outside the formal classroom or laboratory coursework. Regular seminars and colloquia are led by the faculty, students and distinguished speakers from outside LUMS and provides a chance to keep abreast of cutting-edge and high impact research.

Faculty

- **Muhammad Sabieh Anwar**
DPhil, Oxford University, UK
- **Nigum Arshed**
PhD, Quaid-i-Azam University, Pakistan
- **Adam Zaman Chaudhry**
PhD, National University of Singapore, Singapore
- **Muhammad Faryad**
PhD, Pennsylvania State University, USA
- **Fakhar-ul-Inam**
PhD, University of Ohio, USA
- **Amer Iqbal**
PhD, Massachusetts Institute of Technology, USA
- **Babar Ahmad Qureshi**
PhD, Syracuse University, USA
- **Mumtaz Ali Sheikh**
PhD, University of Central Florida, USA

Collaborations and Outreach

There are active collaborations which the faculty and students enjoy with research groups and consortia throughout the world, such as through a Federation Agreement with the Abdus Salam International Centre for Theoretical Physics in Trieste (Italy) and exchange agreements with the University of Electro-communications, Tokyo. Physics students are actively involved in summer research programmes both at LUMS and at other institutes in Pakistan and abroad such as the Summer Exchange with CERN, and contribute to various outreach activities. The Department's teaching laboratories have provided a model that has been successfully replicated at other universities in Pakistan, all within the cost-conscious milieu of the developing world.

Research Groups

The Department of Physics houses well-equipped laboratories. The department's laboratories in Solid State Physics, Nanoscience, Optics And Photonics, Radiation Physics, Measurement and Instrumentation house mostly home-grown facilities in diverse areas of physics. All of this research activity is supported by active mechanical and electronic workshop with trained manpower, and is funded through institutional as well as extramural funding. Cryogenic electronic and thermal transport measurements are possible down to 5 K, thin films and bulk samples can be sputtered (using magnetron techniques) or synthesised at high temperatures and their various dielectric, electronic, thermal, magnetic and optical characterisations can be performed with available equipment such as Atomic Force Microscopy, Ellipsometry, Surface Polarimetry and Magneto-Optical Kerr Imaging. A modern scanning electron microscope with a resolution down to a nanometer is also available not only for imaging but also for lithography. Furthermore, high performance computing resources enable students to solve and visualise problems in research or perform complex mathematical first principle calculations.

Spin and Photon Physics

Principal Investigator: Dr. Sabieh Anwar

In Dr. Sabieh Anwar's multi-disciplinary research group, the aim is to explore the fundamental properties of materials, especially at the nanoscale, and their interaction with external radiation such as light or electromagnetic radiation. Some aspects of this research also bear societal implications. For example, the group is developing polarised, miniaturised and mobilised magnetic resonance systems that can revolutionise the outreach of MRI, extending it to on-field inspections and testing, ambulatory medical care in disaster-struck areas, as well as routine analysis in the chemistry lab fume hood.

Dr. Anwar's group also conducts research on the burgeoning field of spin caloritronics. Temperature gradients can not only generate electrical voltages but also spin voltages which can become the source of energy for future spintronic devices – a whole new paradigm of doing “electronics free of charge!” The group's major emphasis is on detecting and evaluating these spintronic effects using polarised light in the UV-visible range. This work naturally involves an in-depth investigation of magneto-optic effects in condensed matter systems.

Quantum Information Theory

Principal Investigator: Dr. Nigum Arshed

Quantum information theory deals with the storage, transmission and processing of information using quantum-mechanical systems. It is an exciting research field which studies how these tasks can be accomplished using distinct features provided by the underlying mathematical framework provided by quantum mechanics. These features can be used to improve the existing information-theoretic protocols, accomplish tasks and realise goals deemed impossible in the classical realm. One of the major drawbacks of quantum-mechanical systems is that they are fragile due to coupling with their environment. It results into the loss of coherence, a phenomenon known as decoherence. In order to overcome decoherence, it is important to model and understand the dynamics of quantum systems.

Dr. Nigum Arshed's research is focused on modelling quantum channels in spin-boson and cavity QED systems, classical and quantum capacities of quantum channels and quantum memory channels. She is also working on using entanglement, a purely quantum mechanical resource, for efficient and reliable communication of information.

Quantum Dynamics

Principal Investigator: Dr. Adam Zaman Chaudhry

Quantum mechanics has been an extremely successful physical theory that has led to many technological developments: transistors, lasers and MRI being a few examples. In the last two decades, it has been realised that quantum mechanics can lead to many more novel technologies by utilising quantum resources like coherence and entanglement. Before doing so, however, it is essential to understand the dynamics of realistic open quantum systems, that is, systems that interact uncontrollably with the surrounding environment, thereby losing their fragile quantum abilities.

Dr. Chaudhry's research tries to answer three important questions. First, how can the dynamics of open quantum systems be studied? Second, once the dynamics have been understood, what can be done in order to control the dynamics? Third, how can realistic open quantum systems be used in technology? Solving these problems directly impacts many different areas such as quantum optics, control theory, condensed matter, quantum information and chemical physics, leading to many possible applications including, but not limited to, extremely accurate measuring instruments, highly efficient artificial light harvesting systems, and perhaps even quantum computers.

Computational Materials

Principal Investigator: Dr. Fakhar-ul-Inam

The disordered phases of materials have long been a challenging field of research in materials science. The research in this area deals with a wide range of issues, from structure determination and electronic signatures to response under external perturbations and beyond. In the last two decades, the advancement in the first principle treatment of interatomic interactions, such as the density functional theory (DFT), and its merging to the classical molecular dynamic (MD) simulation techniques, have allowed researchers to explore the structural and electronic properties of materials at the atomic scale. Dr. Inam's group's primary interest has been to explore the fundamental properties of materials using first principles molecular dynamics simulations and other theoretical techniques.

Plasmonics and Nanoengineered Materials

Principal investigator: Dr. Muhammad Faryad

Surface plasmon-polariton (SPP) waves are guided by an interface of a metal and a dielectric material. Due to the localisation of SPP waves to the interface, they are important in solar cells, chemical sensors and plasmonic communication. Dr. Faryad has extensive experience in the study of SPP waves that are guided by interfaces of metal and nanoengineered dielectric materials such as sculptured thin films. Besides surface waves, the sculptured thin films find applications in optical filtering and polarised light sources.

Thin-film solar cells have a nano-scale morphology that is nanoengineered to maximise the absorption of light and maximise the collection of light-generated carriers. These solar cells offer an alternative and inexpensive route to "thick" solar cells, eg crystalline silicon and GaAs, by relaxing the constraints on the material properties and reducing the volume of material significantly. Dr. Faryad's group is working on the techniques to increase the light absorption in thin film solar cells, such as amorphous silicon, using nanostructured back reflectors. a super-resolution confocal microscope using disordered media. He is also interested in the areas of optical communication, singular optics and 3D laser ranging.

String Theory

Principal Investigator: Dr. Amer Iqbal

Dr. Amer Iqbal's research interests are at the cutting edge frontiers of the small and large-scale structure of the universe. One of the most profound theories for describing the fundamental make-up of the universe is string theory which posits that electrons and quarks are not point-like particles but strings vibrating in a higher-dimensional space time.

The theory has implications for a possible unification of Einstein's general relativity and quantum theory – a happy confluence between the macro and the microcosm. One aspect of Dr. Iqbal's work focuses on the inter-connection and reconciliation between various string theories, their application to gauge theories and mathematical aspects of topological strings. It is well known that strings propagating on singular backgrounds give rise to gauge theories in a certain limit. A related question is the geometry of spacetime itself. Answers to these questions will help researchers in satiating some of the intrigue mankind has harboured from its very origins, about the world they live in.

Knots also interest Dr. Amer's group. They are classified by their deformation properties: two knots are distinct if they cannot be transformed into one another without breaking the lace. An active area of pursuit right at the interface of mathematically inspired physics is seeing how knots link up with topological strings.

Fundamental Theory

Principal Investigator: Dr. Babar Ahmed Qureshi

The main area of interest is how quantum mechanics changes ideas about space-time. There is a top down and a bottom up approach to this problem. The fundamental uncertainties inherent in quantum mechanics cause severe deformation of space-time structure at very small scales, breaking down the smooth manifold structure of general relativity into something called quantum foam. Dr. Babar Ahmed Qureshi explores these phenomena by studying field theories on these structures. In the bottom up approach, he is interested in studying how spacetime itself, along with quantum fields, emerges from more fundamental objects such as matrices, as hinted by M-theory.

He is also curious about the cosmological implications of these ideas. Other focus areas include many mathematical aspects of physics including quantum groups and their use in describing Quantum Hall States, which may be of particular use in devising a practical quantum computer. He is also working on some aspects of the now famous duality between gravitational and gauge theories.

Photonics

Principal Investigator: Dr. Mumtaz Ali Sheikh

The use of optics in everyday life is ubiquitous. For example, internet is used all the time without realising that ultimately these are light pulses that carry the information across the world on a fibre optic network. The foundations for newer television display technologies like LCDs, LEDs and three-dimensional TVs were laid by optical physicists. Digital SLR cameras are more expensive than ordinary cameras because they use more complicated optics. Now, there is a push towards development of optical computers as well.

Dr. Mumtaz Ali Sheikh focuses on using light for a large variety of similar applications. He has been involved in the development of extreme temperature optical sensors for use in gas turbines at temperatures where ordinary industrial thermocouples break down very quickly. His current projects include the development of a super-resolution confocal microscope using disordered media. He is also interested in the areas of optical communication, singular optics and 3D laser ranging.

Research Facilities

The Department of Physics houses well-equipped laboratories. The department's laboratories in Solid State Physics, Nanoscience, Optics and Photonics, Radiation Physics, Measurement and Instrumentation house mostly home-grown facilities in diverse areas of physics. All of this research activity is supported by active mechanical and electronic workshop with trained manpower, and is funded through institutional as well as extramural funding. Cryogenic electronic and thermal transport measurements are possible down to 5 K, thin films and bulk samples can be sputtered (using magnetron techniques) or synthesised at high temperatures and their various dielectric, electronic, thermal, magnetic and optical characterisations can be performed with available equipment such as atomic force microscopy, ellipsometry, surface polarimetry, vibrating sample magnetometry, and magneto-optical Kerr Imaging. A modern scanning electron microscope with a resolution down to a nanometer is also available not only for imaging but also for lithography. Furthermore, high performance computing resources enable students to solve and visualise problems in research or perform complex mathematical first principle calculations.

ADMISSION ELIGIBILITY GUIDELINES

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

- Academic Record
- Performance in Admission Tests
- Interview Performance (if applicable)
- Completed application form along with all supporting documents

ACADEMIC RECORD

For MS:

- A minimum of 16 years of education is required for applying to the MS programme
- Applicants must have maintained CGPA of at least 2.4 (on a scale of 4) or at least 60% marks in all university-level degrees

For PhD:

- A minimum of 18 years of education is required for applying to the PhD programme
- Applicants must have obtained a CGPA of at least 3.0 (on a scale of 4) or First Division (in the annual system) in their Master's degree and at least a CGPA of 2.4 (on a scale of 4) or 60% marks in Bachelor's degree

Applicants applying to the MS programme must have their Bachelor's (or Master's) degree and applicants applying to the PhD Programme must have their Master's degree in any one of the following areas:

BIOLOGY

- Biology
- Biochemistry
- Bioinformatics
- Molecular Biology
- Microbiology
- Genetics
- Other closely related disciplines

Applicants applying to the MS/ PhD Programmes may also have degrees in MBBS, BDS or Pharm-D. Applicants must have Second Division or above in these degrees to be considered eligible for MS/PhD.

CHEMISTRY

- Chemistry
- Biochemistry
- Materials Science or Engineering
- Chemical Engineering
- Or closely related disciplines

COMPUTER SCIENCE

- Computer Science
- Software Engineering
- Information Technology

For PhD: Other closely related disciplines

For MS: Other closely related disciplines that are synergistically aligned with computing (e.g. Mathematics, Statistics, Accounting, Economics or Management Sciences) and involve rigorous coursework in Mathematics and strong programming background.

Electrical Engineering

- Electrical Engineering
- Electronics
- Computer Science
- Engineering/Applied Physics
- Mechatronics Engineering
- Computer Engineering
- Telecomm Engineering
- Other engineering disciplines peripherally related to electronics or electrical engineering

MATHEMATICS

- Mathematics
- Statistics
- Physics
- Other closely related disciplines determined by Mathematics Graduate Committee

PHYSICS

- Physics
- Mathematics
- Computer Science
- Materials Science
- Optics
- Engineering
- Other closely related or allied Engineering disciplines

PERFORMANCE IN ADMISSION TESTS

For MS/PhD :

- Applicants to the MS/PhD programme are required to take the LUMS Graduate Admission Test (LGAT), which is comprised of quantitative, verbal and analytical sections.
- Applicants who have taken the Graduate Record Examination (GRE) General Test during the last two years and obtained an aggregate score of 300 in the Quantitative and Verbal may choose not to take the LGAT.
- In addition, applicants must also take the SBASSE Subject Test in their respective discipline i.e. Biology, Chemistry, Computer Science, Electrical Engineering, Mathematics & Physics.
- Applicants are exempted from SBASSE Subject Test if they have taken GRE Subject Test during the last two years and obtained a score at the 60th percentile or above in the discipline they are applying to:

- o Biology: GRE Subject Test in Biology, or Biochemistry, Cell and Molecular Biology
- o Chemistry: GRE Subject Test in Chemistry
- o Mathematics: GRE Subject Test in Mathematics
- o Physics: GRE Subject Test in Physics

Note:

This is the minimum criteria applicants need to fulfill in order to be eligible to apply. Meeting the criteria does not guarantee admission into LUMS.

Applicants residing outside Pakistan are required to take the GRE General Test as well as the GRE Subject Test (through the Educational Testing Service, ETS USA (www.ets.org)) in the disciplines mentioned before.

- LGAT and SBASSE Subject Tests will be scheduled at the same time in Lahore, Islamabad and Karachi on April 12, 2015.

- The deadline to take GRE/GRE Subject Test (if applicable) is March 20, 2015 at the latest. The college code for reporting GRE scores to LUMS is 0679.

INTERVIEW

- All PhD applicants are required to go through an interview that includes delivery of a seminar on their MS research work
- Only some MS applicants may be requested to appear for an interview

