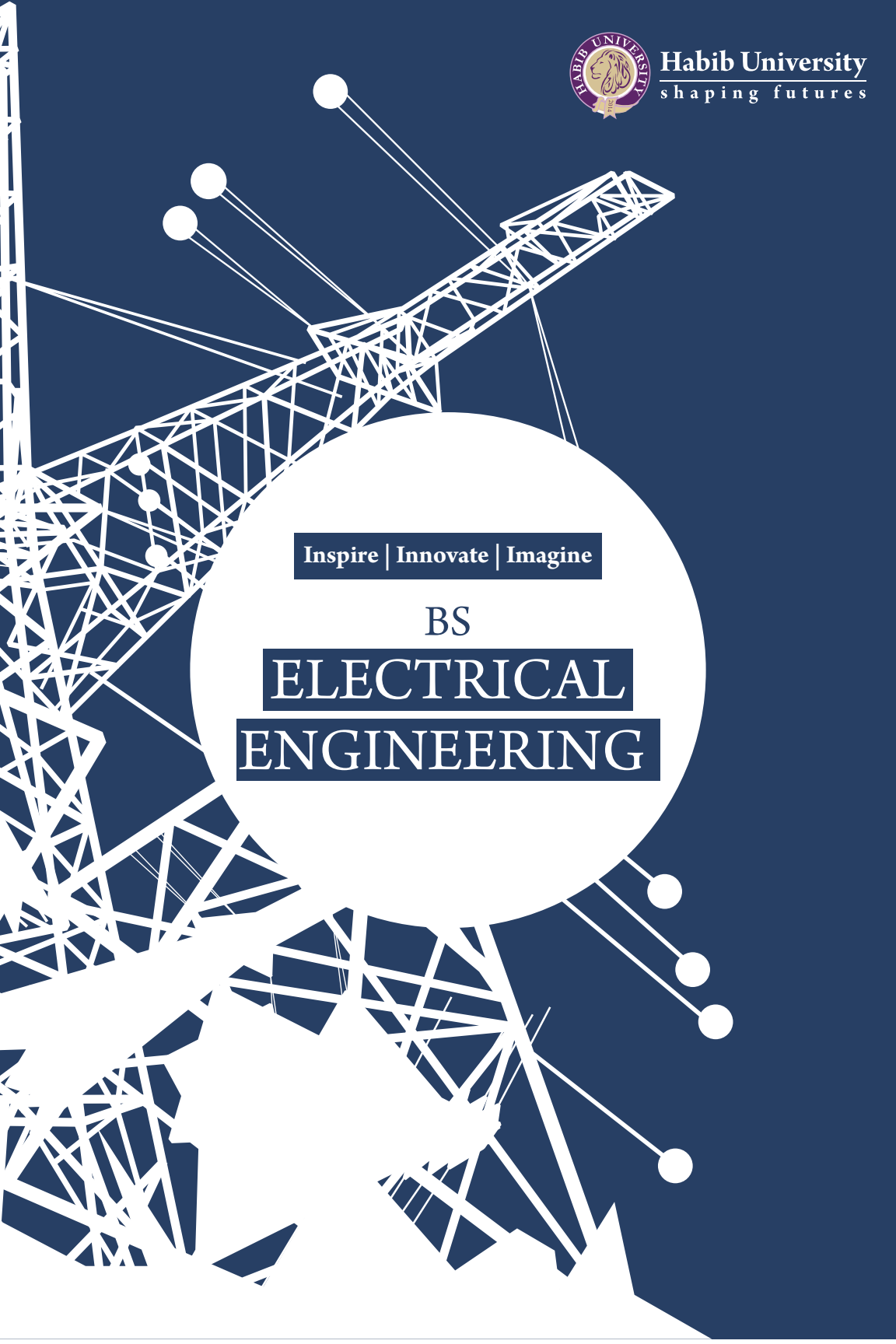
Habib University
shaping futures



Inspire | Innovate | Imagine

BS ELECTRICAL ENGINEERING

BS IN
Electrical Engineering

FACULTY MEMBERS:

Makda, Ishtiyaq Ahmed, Assistant Professor
Mughal, Ozair, Lecturer
Memon, Abdul Basit, Assistant Professor
Mumtaz, Tariq, Lecturer
Shaikh, Mohammad Shahid, Associate Professor & Program Director
Shumail, Muhammad, Assistant Professor
Spracklen, Charles Timothy, Professor of Electrical Engineering & Physics
Zaidi, Shoaib, Professor of Electrical Engineering & Physics, (Dean, SSE)

Modern life is unimaginable without electricity. The generation, transmission, distribution and utilization of electricity is made possible mainly through the work of Electrical Engineers. They design and build communication systems such as mobile phone and computer networks, design microelectronic silicon chips that are at the heart of modern computing devices, develop biomedical devices and instrumentation to saves lives, and advance new 'green' technologies that will power our homes and industries while protecting the environment.
Habib University Electrical Engineering Program combines a rigorous science and engineering education with the liberal arts. It provides students with technical knowledge in Mathematics and Sciences, Computation, Electronics, Power and Energy Systems, Electromagnetics, Telecommunication Systems, Automation and Control Systems.

Program Vision

To be an agent of positive change in society through excellence in locally contextualized and globally competitive liberal-arts and discipline-specific education and research, and imparting an understanding of contemporary issues and challenges facing the society.

PROGRAM EDUCATIONAL OBJECTIVES

Electrical Engineering program at Habib University aims to produce competent electrical engineers who

- have excellent technical expertise in the discipline, including the latest and emerging technologies;
- practice their profession responsibly, with an awareness of civic duties and contemporary issues, and an understanding of economic, social, environmental, professional and ethical issues and of the impact of their work on society and

environment;
- have an appreciation of non-technical disciplines, possess excellent communication skills, and are comfortable working in teams composed of individuals with diverse cultural and educational backgrounds;
- engage in the lifelong process of independent, reflective learning.

PROGRAM LEARNING OUTCOMES

Following Program Learning Outcomes (PLO) are designed to prepare graduates to attain the program educational objectives and subsume the PLOs of Pakistan Engineering Council (PEC) and Accreditation Board for Engineering and Technology (ABET).

Electrical Engineering program at Habib University aims to produce electrical engineers who, at the time of graduation, have

(i) an ability to apply knowledge of mathematics, science, engineering fundamentals and electrical engineering to the solution of complex engineering problems;

(ii) an ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations;

(iii) an ability to investigate engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis using first principles of mathematics, natural sciences and engineering sciences, and interpretation of experimental data, and synthesis of information to derive valid conclusions;

(iv) an ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools to engineering activities, with an understanding of the limitations;

(v) an ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to engineering problems;

(vi) an ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development;

(vii) an commitment to professional ethics and responsibilities and norms of engineering practice;

(viii) an ability to work effectively, as an individual or in a team, in multifaceted and or multidisciplinary settings;

(ix) an ability to communicate effectively, orally as well as in writing, with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions;

(x) an ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment;

(xi) an ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments;

(xii) a knowledge of contemporary issues.

THE ACADEMIC PROGRAM

The first year of the program provides firm grounding in natural sciences, mathematics, computing and electrical engineering. Foundational courses in computer science and electrical engineering will provide students a meaningful introduction to both the disciplines. Students will then take core electrical engineering and mathematics courses that will provide a solid foundation for taking more advanced elective courses. The final year is devoted to a year-long capstone project, technical electives, and supporting courses. Alongside their specialized training, students are required to take courses outside their major to facilitate a broad exposure to knowledge. This includes the mandatory Habib Liberal Core component.

REQUIREMENTS FOR THE MAJOR

A major in Electrical Engineering requires completion of approximately 140 credit hours of coursework, with a minimum CGPA of 2.33, as shown in the table below:

Course Category	Number of Courses to complete		
	Total	**Compulsory**	**Elective**
University Requirements			
Habib Liberal Core	10	10	0
Economics and Management			
Economics, Management and Entrepreneurship	2	2	0
Mathematics and Natural Sciences			
Mathematics Natural Sciences	4 2	4 2	0 8
			Total

Course Category	Number of Courses to complete		
	Total	Compulsory	Elective
Computing			
Programming, Algorithms and Data Structures	2	2	0
Electrical Engineering Foundation			
Circuits and Electronics	3	3	0
Analog and Digital Signals and Systems	2	2	0
Hardware and Interfacing	2	2	0
Engineering Workshop Practice	1	1	0
			Total
Electrical Engineering Breadth			
Electrical Machines	1	1	0
Electromagnetic Theory	1	1	0
Signals, Communications and Control	2	2	0
			Total
Electrical Engineering Depth			
Electives	5	0	5
Interdisciplinary Engineering Cours			
Engineering Courses other than Electrical Engineering	2	2	0
Capstone Project			
Capstone Project	2	2	0
Overall	46	41	5

Program Thrusts

Three program specializations are defined. Students have an option to specialize in one of these areas by taking appropriate elective courses in consultation with their academic advisor.

Electronics and Embedded Systems

Modern electronics are ubiquitous in consumer, industrial, automotive, medical, commercial, and military applications. The percentage of electronics in traditionally mechanical systems, such as automobiles, has steadily increased to more than 30% and is expected to increase further. This trend of 'electronification' of society, coupled with the availability of inexpensive but powerful embedded systems, opens up a huge valley of opportunities for well-trained electronic engineers and entrepreneurs.

Power and Energy Systems
Ready availability of electrical power at a reasonable price is essential for the economic development of a country. In order to come out of the current energy crisis Pakistan needs to launch more power generation projects, upgrade its transmission network and modernize the distribution system in order to reduce distribution losses. All this will be done by electrical engineers who specialize in power systems.

Telecommunications
Cellular mobile phone networks, satellite and fiber-optics communication systems, and global positioning systems are playing a fundamental role in increasing the quality of life and improving the efficiency of the service sector. A well-knit telecommunications infrastructure is essential for the economic development of a country. In Pakistan we are witnessing the introduction of 4G LTE cellular phone systems, proliferation of data networks, and a shift towards electronically facilitated services by both the public and private sector. Telecommunications thrust is intended to sustain the positive growth in this industry by providing adequately trained technical managers, leaders, and entrepreneurs.

Course Descriptions

SSE

MGMT 201. Technology Management and Entrepreneurship
Topics include: managing technological transitions, intellectual property, creating and managing an innovative organization, managing research and development, organizational learning, economist and sociologist views of entrepreneurship, the process and management of entrepreneurship, the importance of innovation, teamwork, financial and marketing aspects, product quality; study will be supplemented with case studies.

ECON 201. Engineering Economics
Topics include: Application of economic principles to engineering solutions, time value of money, cash flow analysis, quantization of profitability, methods of evaluating investments, comparison of alternative investments, inflation, depreciation, resource depletion, economic analysis of projects, economic management of engineering projects.

ELECTRICAL ENGINEERING

EE 111. Electric Circuit Analysis
This course introduces basic DC and AC steady-state linear circuit analysis. Topics discussed in this course include circuit elements, Ohm's law and Kirchhoff's laws, node and mesh analysis, energy storage elements, Thevenin and Norton theorem, Phasors and sinusoidal steady state analysis. Computer applications in circuit simulation and numerical solution is also discussed.

EE 172. Digital Logic and Design
Introduction to the design of digital hardware, realization of computation with logic gates; Boolean algebra, design of combinational logic circuits and analysis and design of clocked sequential logic circuits, circuits for arithmetic operations; introduction to hardware description language and its application to logic design. (Cross-listed with CS 130.)

EGR 291. Engineering Workshop
This course aims to introduce the students to hands-on practical engineering skills, necessary for creating their own prototypes. Topics covered in this course include introduction to engineering design process, shop safety, engineering drawing, solid modeling (CAD), 3D printing, effective use of basic hand tools such as saws and files, machining (Lathe, Milling, Drill press), CNC machining, soldering techniques, and PCB design and printing. The course work emphasizes practical skills through lab activities and project. The students will be required to work with different materials including metal, wood, and plastic.

EE 211. Basic Electronics
The course aims to introduce students to semiconductor devices, with emphasis on application of these devices in realizing analog and digital electronic circuits. The course starts with an introduction to semiconductors, energy bands, valence bonds, doping, N-type and P-type semi-conductors, etc. The electronic devices, such as PN junction diode, bipolar junction transistor (BJT) and field-effect transistor (FET), along with their applications are discussed in detail. Biasing circuits, single transistor amplifiers and their frequency are also discussed. Circuit simulations using PSpice (OrCAD) forms an important bridge between the theory discussed in class and lab experiments.
Prerequisite: EE 111.

EE 252. Signals and Systems
Types of signals; unit impulse and unit step functions; linear time invariant (LTI) systems and their properties; convolution sum and convolution integral; Fourier series, Fourier, Laplace and Z transforms; analysis and characterization of LTI systems using various transforms.
Prerequisite: MATH 101.

EE 331. Electrical Machines
This is the first course on DC and AC electromechanical systems. Specific topics include single-phase and three-phase transformers, general structure and physical principles underlying electric drive systems, brushless, stepper and switched reluctance DC motors, DC generators, Induction and Synchronous AC motors and generators, torque-speed characteristics of motor drives. Mathematical modeling and speed control of electrical machines will also be discussed.
Prerequisite: PHY 102, EE 212.

EE 241. Electromagnetic Theory
Extension of static electric and magnetic fields to time-varying fields and electromagnetic waves; Maxwell's equations; propagation of electromagnetic waves through different types of media and their behavior at the interfaces.
Prerequisite: MATH 102; PHY 102.

EE 354 Probability and Stochastic Processes
Set theory and counting principles, axiomatic definition of probability, independence and conditional probability, Bayes' theorem; random variables (RVs) and their cumulative distribution function, probability mass functions, probability density functions and moments; joint RVs; limits theorems; introduction to stochastic processes; applications.
Prerequisite: MATH 102.

EE 322. Analog and Digital Communication
Introduction to fundamental principles underlying the analysis, design and optimization of analog and digital communication systems; modulation techniques for analog and digital communication; effects of interference and noise and their suppression.
Prerequisite: EE 252.

EE 353. Digital Signal Processing
Introduction to digital signal representations in time and frequency domains; signal manipulations via filters and resampling; signal creation and capture and processing with real-time computing machinery.
Prerequisite: EE 252.

EE 361. Principles of Feedback Control
Topics include: Models of dynamic systems, linear time-invariant (LTI) and transfer function models; impulse, step, transient and steady-state response; root locus technique, Bodé plots, Nyquist criterion; gain and phase margins, Nichols charts, lead, lag compensation; state-space techniques; simulation and controller design using Matlab and Simulink.
Prerequisite: EE 252.

EE 373. Microcontrollers and Interfacing
Microcontrollers play a central role in modern life, controlling everything from the engine of a car, to domestic and office machinery. Microcontroller fundamentals including architecture, assembly language programming, and interfacing. Applications of industry-standard microcontrollers in embedded systems. Employs software design tools, simulators, and hardware trainers. Will focus on interfacing the ARM RISC processor to motors, actuators and sensors.
Prerequisite: EE 172.

EE 491. Capstone Project I
EE 492. Capstone Project II

This year-long sequence represents the culmination of study towards the BS degree. Students work individually or in small teams on a project in which they utilize the knowledge acquired during the first three years of education. Each project is closely supervised by a faculty member and each team produces a comprehensive report at the end of the project.
Prerequisite: Approval of an EE faculty capstone committee.

HABIB UNIVERSITY:
UNIVERSITY AVENUE, OFF SHAHRAH-E-FAISAL,
GULISTAN-E-JAUHAR, KARACHI

For complete course description and department requirements,
see Habib's online course catalog at www.habib.edu.pk

https://habib.edu.pk/academics/sse/electrical-engineering/

www.habib.edu.pk

admissions@habib.edu.pk

+92 21 11 10 HABIB (42242)

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