

Department of Electrical Engineering

Thrust Research Areas

Islamic University of Science and Technology (IUST)

Research focus areas for teaching, innovation, and collaboration

Thrust Research Areas

The Department of Electrical Engineering focuses on advanced research domains aligned with emerging technologies and evolving power and energy systems. The following thrust areas emphasize analytical modeling, system design, optimization, and real-world implementation.

Smart Grids and Advanced Power Systems

Research includes modeling, analysis, and control of modern power systems with high penetration of distributed energy resources. Key topics include state estimation, demand response, grid stability, synchrophasor applications, and cyber-physical aspects of smart grids.

Renewable Energy Systems and Integration

This area covers the design, control, and optimization of renewable energy systems such as solar photovoltaic, wind energy, and small hydro. Emphasis is placed on grid integration, power quality, forecasting, and hybrid energy system modeling.

Electric Vehicle Technology

Research focuses on electric drivetrain systems, battery modeling and management systems (BMS), charging strategies, and grid interaction. Topics include fast-charging techniques, vehicle-to-grid (V2G) systems, and power electronic converters for EV applications.

Energy Storage Systems

Work in this domain involves electrochemical energy storage modeling, state-of-charge estimation, battery degradation analysis, and integration of storage systems into power networks for stability and load leveling.

Power Electronics and Electric Drives

This area includes the design, control, and optimization of power converters and electric drives. Topics include multilevel inverters, DC-DC converters, modulation techniques, and high-performance motor control for industrial and mobility applications.

Artificial Intelligence and Machine Learning Applications

Research explores data-driven approaches for power system analysis, including load forecasting, fault classification, predictive maintenance, and optimization using machine learning and deep learning techniques.

Internet of Things (IoT) and Embedded Systems

Focus is on sensor networks, embedded platforms, and communication protocols for real-time monitoring and control of electrical systems. Applications include smart grids, home automation, and industrial IoT.

High Voltage Engineering and Insulation Diagnostics

This domain covers high voltage generation, insulation design, partial discharge analysis, condition monitoring, and reliability assessment of electrical equipment.

Robotics, Control, and Automation

Research includes advanced control strategies, system identification, robotics, and automation techniques for industrial processes and autonomous systems.

Distributed Generation and Rural Energy Systems

This area focuses on decentralized power generation, microgrids, and standalone systems, with emphasis on optimal design, control, and reliability in remote and rural environments.

Interdisciplinary Research

Collaborative research is carried out at the intersection of electrical engineering with computer science, materials science, and environmental engineering, addressing complex engineering challenges.