

Department of Electrical Engineering

Laboratories and Specialised Facilities

The Department of Electrical Engineering has established a modern laboratory ecosystem to support undergraduate, postgraduate and doctoral education, research, consultancy and innovation. The laboratories integrate experimentation, modelling, simulation and prototype development in the areas of electrical machines, power systems, electric mobility, renewable energy, power electronics, control systems and intelligent energy systems. During the last few years, the department has significantly upgraded its infrastructure through the establishment of an **Electric Vehicle Technology Laboratory**, expansion of the **Renewable Energy Laboratory**, and acquisition of advanced testing, measurement and simulation facilities to support emerging technologies.

Teaching and Research Laboratories

Power Systems and Protection Laboratory	Transmission line modelling, protection relays, fault analysis, power quality studies
Power Electronics and Drives Laboratory	Converters, inverters, motor drives, PWM techniques, power electronic experimentation
Electric Vehicle Technology Laboratory	Electric vehicle drivetrain, charging systems, battery technologies, EV power electronics and control
Renewable Energy Systems Laboratory	Solar photovoltaic systems, hybrid renewable energy systems, grid-connected operation
Electrical Machines Laboratory	Transformers, DC machines, induction motors, synchronous machines
Instrumentation and Control Laboratory	Sensors, instrumentation, Classical and modern control, real-time control implementation, digital control
Simulation and Computational Engineering Laboratory	MATLAB, PSCAD, ANSYS, HOMER, numerical modelling and system simulation
Basic Electrical Engineering Laboratory	Fundamental electrical circuits, Fundamental measurements

Major Research Infrastructure

Electric Vehicle Technology

- Two-wheeler electric vehicle drivetrain with charging infrastructure.
- Battery Management System (BMS) experimental platform.
- Battery analyser for performance evaluation and diagnostics.

- Electric motor drive and controller development platform.
- DC–DC converter and inverter development kits.

Renewable Energy Systems

- Grid-connected and hybrid Solar Photovoltaic systems (approximately 14 kW).
- Polycrystalline, monocrystalline and bifacial photovoltaic modules.
- Solar PV trainer and grid-interactive laboratory setup.
- PV analyser.
- Irradiance meter.
- Experimental facilities for renewable energy integration and distributed generation.

Power Systems, Machines and Drives

- LD Didactic (Germany) Dissectible Machine System configurable into multiple electrical machine configurations.
- Numerical Differential Relay trainer.
- Three-phase inverter trainer system.
- Fluke Power Quality Analyser for harmonics, transients, voltage sag/swell and power quality studies.
- Advanced electrical machines and industrial drive experimental setups.
- Fluke Earth Resistance tester

Computational and Design Facilities

- Licensed MATLAB/Simulink.
- PSCAD.
- ANSYS.
- HOMER Pro.
- Software tools supporting modelling, optimisation, controller design, electric vehicle technology, renewable energy systems and smart grids.

Research Focus Supported by the Laboratories

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| • Electric Vehicle Technology | • Smart Grids |
| • Battery Energy Storage Systems | • Power Electronics |
| • Renewable Energy Systems | • Electrical Drives |

- Control Systems
- Artificial Intelligence for Energy Systems
- Digital Twins
- Model Order Reduction
- Power System Protection
- Computational Engineering

Future Expansion

The Department is continuously upgrading its laboratory infrastructure to support emerging technologies and interdisciplinary research. Planned developments include expansion of facilities in Electric Vehicle Technology, Battery Energy Storage Systems, Smart Grids, Advanced Power Electronics, Solar PV Systems, Digital Twins, Artificial Intelligence for Energy Systems and Hardware-in-the-Loop (HIL) based experimentation. These facilities are expected to strengthen the department's teaching, research, consultancy and innovation ecosystem while supporting future-ready engineering education.