Analog Electrical Circuits Laboratory – B151-007

Analog electrical circuits is a field of study where various circuits are studied which helps in bridging the gap between the real world and analog world. Analog electrical circuits lab design is one of the important and challenging field in analog applications. During this Lab course simple analog electronic circuits are designed using discrete components like Resistors, Capacitors, Inductors, PN junction diodes and Transistors (BJT's, FET's, etc.). These designed circuits are tested and verified for their performance under the laboratory conditions using power sources like DC Power supply, AC sources like function generators. Their input and output parameters like input waveforms, output waveforms, input and output current and voltage readings, the impedance or resistance offered by the circuit, etc are analyzed by using measuring instruments like multi-meter and CRO's. The captured values from the instruments are noted and used for further calculations.

The purpose of this course is to teach students the fundamentals of analog and digital electronic systems. The student will be able to incorporate these concepts into their electronic designs for other courses where control can be achieved via a operational amplifier implementation. Topics include various applications of operational amplifiers.

Objectives:

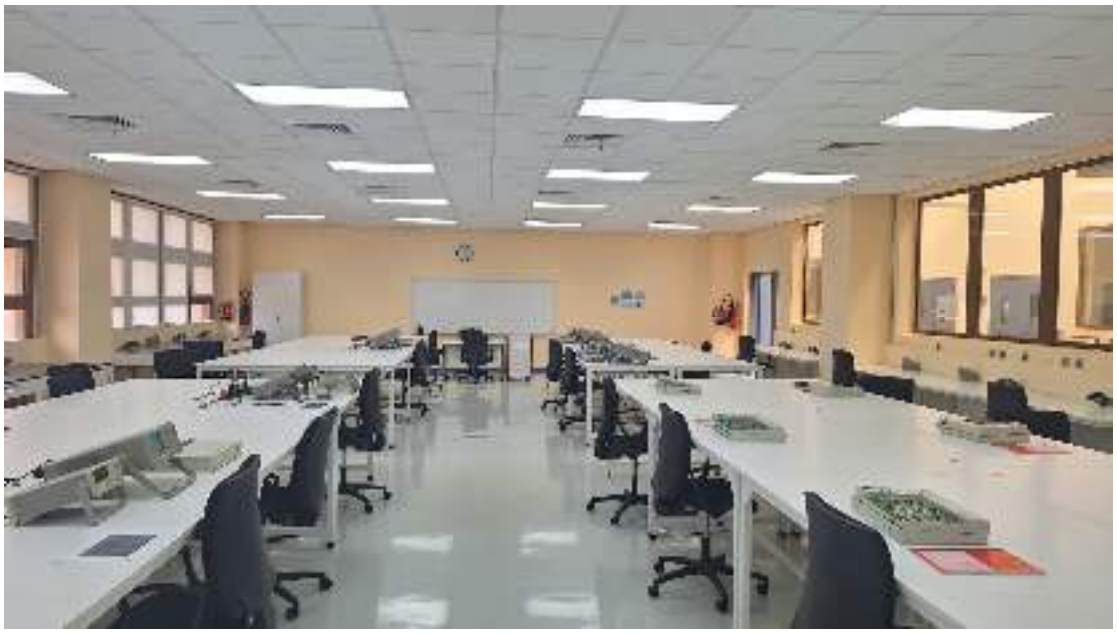
- Emphasize the concepts taught in the analog and digital electronic course.
- Gain the laboratory benefits of modeling an actual Ideal and Non-Ideal Op-amp circuits and its applications.
- Analyze different analog and digital electronic circuits such as BJT, CMOS, TTL and ECL.
- Emphasizing the concepts taught in the theoretical courses, and preparing them to do experimental work in their graduation project when necessary

Common Experiments:

- AMPLIFYING CIRCUITS includes Inverting, Non-inverting and Voltage Follower Amplifier.
- FLIPFLOP CIRCUITS includes Comparator, Schmitt Trigger and Astable Multivibrator.
- COMPUTING CIRCUITS includes Adder, Differentiator and Integrator.
- ACTIVE FILTER CIRCUITS includes High Pass Filter, Low Pass Filter and Band Pass Filter.
- APPLICATION CIRCUITS includes Constant current sources and Precisio Voltage Sources.

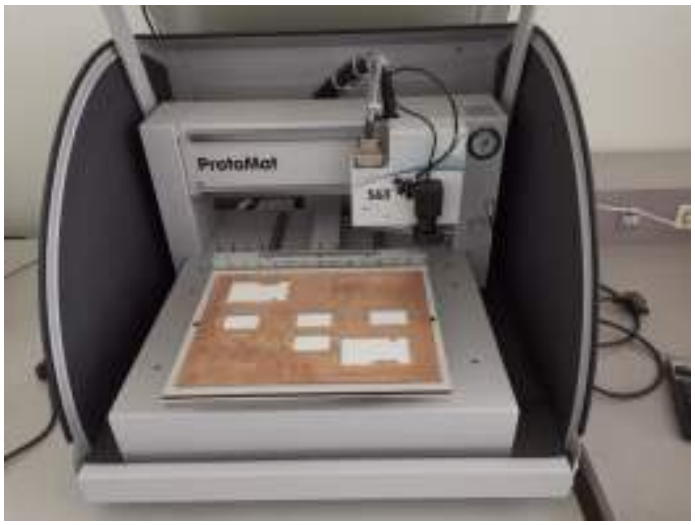
Equipment Used:

Discrete components, Operational Amplifier, Multimeters, CROs, Function Generator, Dual Power Supply.




COR3LAB


LPKF


ProtoMat

AUTOMATIC CONTROL LAB -B15, Room: 2-1-007

The Automatic Control Laboratory in the Department of Electrical Engineering is designed to provide students with hands-on experience in control system engineering. The lab is equipped with PID controllers and PLC setup featuring the Siemens SIMATIC S7-1200 series, allowing students to explore a wide range of control applications and automation processes.

Objectives

- To train, understand and implement Proportional-Integral-Derivative (PID) control strategies
- To provide the students with a platform to design, program, and implement automation projects
- To implement basic and advanced applications, supporting a variety of control tasks, including sequential control, analogue signal processing, and communication protocols
- To understand control system principles and automation techniques

Common Experiments:

- P-Proportional Controller, I-Integral Controller and D-Differential Controller
- PI and PD Controllers
- PID Controller and Comparison

Equipment Used: Siemens SIMATIC S7-1200 PLC Setup and Siemens SIMATIC S7-1200 PLC Setup

COMMUNICATIONS LAB -B15, Room: 2-1-006

The Communications Laboratory provides students with a hands-on environment to explore and understand the foundational principles of communication systems. Through practical module systems, students conduct experiments that bridge the gap between theoretical knowledge and real-world application.

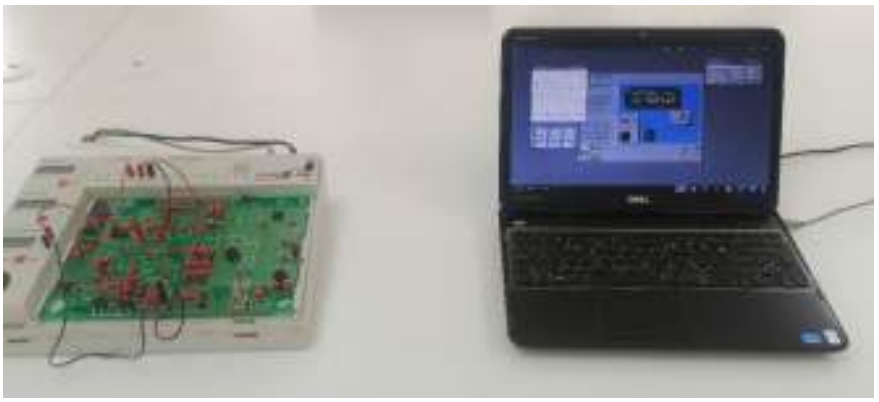
Objectives

- To understand the concept of modulation: Analog and digital
- To gain the knowledge and skills in using Software and Hardware related to Modulation and Demodulation
- To learn how to use Measurement devices such as Cathode ray Oscilloscope (CRO), Function Generator, Spectrum Analyze (FFT module)
- To study and implement the concepts of digital modulation and digital transmission techniques

Common Experiments:

- Amplitude and frequency modulation
- pulse amplitude modulation (PAM) and pulse code modulation (PCM)
- Signaling methods like PSK, FSK, DPSK, QPSK, and MSK

Equipment Used: Universal board(70000), Com3lab software, Transmission technology board, Communication technology board and digital communication technology boards



Electrical Circuits Lab – B15-1-030

The Electrical Circuits Lab provides students with a practical environment to explore and analyze basic electrical circuits. In this lab, students engage in hands-on experiments that reinforce theoretical concepts learned in the classroom. They perform detailed circuit measurements, including voltage, current, and resistance, using modern equipment such as mustimeters, oscilloscopes, and function generators. The lab exercises cover a wide range of topics, including Ohm's Law, Kirchhoff's Laws, series and parallel circuits, and AC/DC circuit analysis. By constructing and testing circuits, students gain a deeper understanding of circuit behaviour, component functions, and the principles of electrical engineering, which are essential for their future studies and professional careers.

Objective

The objective of the Electrical Circuits Laboratory is to equip students with essential hands-on skills and knowledge in using fundamental electrical circuits and electrical measuring equipment such as galvanometers, ammeter, voltmeter, function generators, voltage, current and power measurement. The lab aims to:

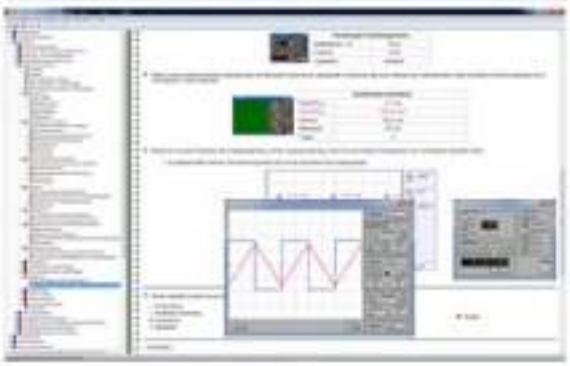
- To develop practical skills in Circuit Construction and Analysis.
- To master Circuit Measurement Techniques.
- To apply fundamental electrical engineering laws and theories.
- To understand AC and DC circuit behaviour.
- To enhance problem-solving and critical thinking skills.
- To prepare for advanced studies and professional application.
- To prepare students for advanced courses in electrical engineering and related fields.
- To cultivate confidence in using laboratory equipment.

Common Experiments

Basic Measurements of voltage, current, AC and DC power, Measurement of resistance, inductance, capacitance using different bridge circuits. Galvanometer implementation for different bridge circuits.

Equipment Used

Plug-in Component Board (SO4204- 8A, 8B, 8C and 8D), Unitrain Interface (Model: SO4203-2A), Experimenter (Model: SO4203-2), Power Supply(Model: SO4203-2A),



ELECTRICAL POWER LAB –B15-1-010

An **Electrical Machines Laboratory** is an essential part of an electrical engineering curriculum, providing a hands-on environment where students can apply theoretical concepts related to electrical machines. This lab is equipped with various machines like DC motors, induction motors, synchronous generators, and transformers, along with measurement instruments to analyze machine performance under different operational conditions. The lab focuses on developing practical skills in handling and testing electrical machines, observing operational behavior, and understanding energy conversion principles. By bridging theory and practice, this lab helps students grasp complex concepts such as electromagnetism, machine efficiency, torque, and power losses.

Objectives:

- Understanding Machine Fundamentals
- Practical Application of Theoretical Knowledge
- Performance Analysis and Testing
- Machine Control Techniques
- Fault Diagnosis and Troubleshooting
- Safety Protocols in Handling Electrical Equipment
- Data Acquisition and Analysis Skills
- Real-World Applications

Common Experiments:

1. To determine the impedance of a coil at DC and AC voltage.
2. To determine the coil inductance by the use of the V-I method
3. To determine the coil inductance by the three-voltmeters method.
4. To apply on assembly, operation, and disassembly of a DC machine.
5. No load characteristics of separately excited DC generator.
6. Load characteristics of separately excited DC generator.
7. Load characteristics of a separately excited DC motor.
8. Speed control of separately excited DC motor.
9. Load test of single-phase transformer.
10. Equivalent Circuit Parameters of single-phase transformer.
11. Equivalent Circuit Parameters of three phase synchronous generator.
12. Equivalent Circuit Parameters of three phase induction motor.
13. Load test of three phase induction motor.
14. Operation of a Three-Phase Alternator

Equipment Used:

DC Motor/ Generator

Squirrel Cage Induction Motor.

3-Phase Wound Rotor Induction Motor

Synchronize Motor/ Generator

Resistive Load

Inductive Load

Capacitive Load

Electric Transformer

DC Voltmeter/Ammeter.

AC Ammeter.

AC Voltmeter.

Single Phase Wattmeter.

3- Phase Wattmeter.

Power Supply

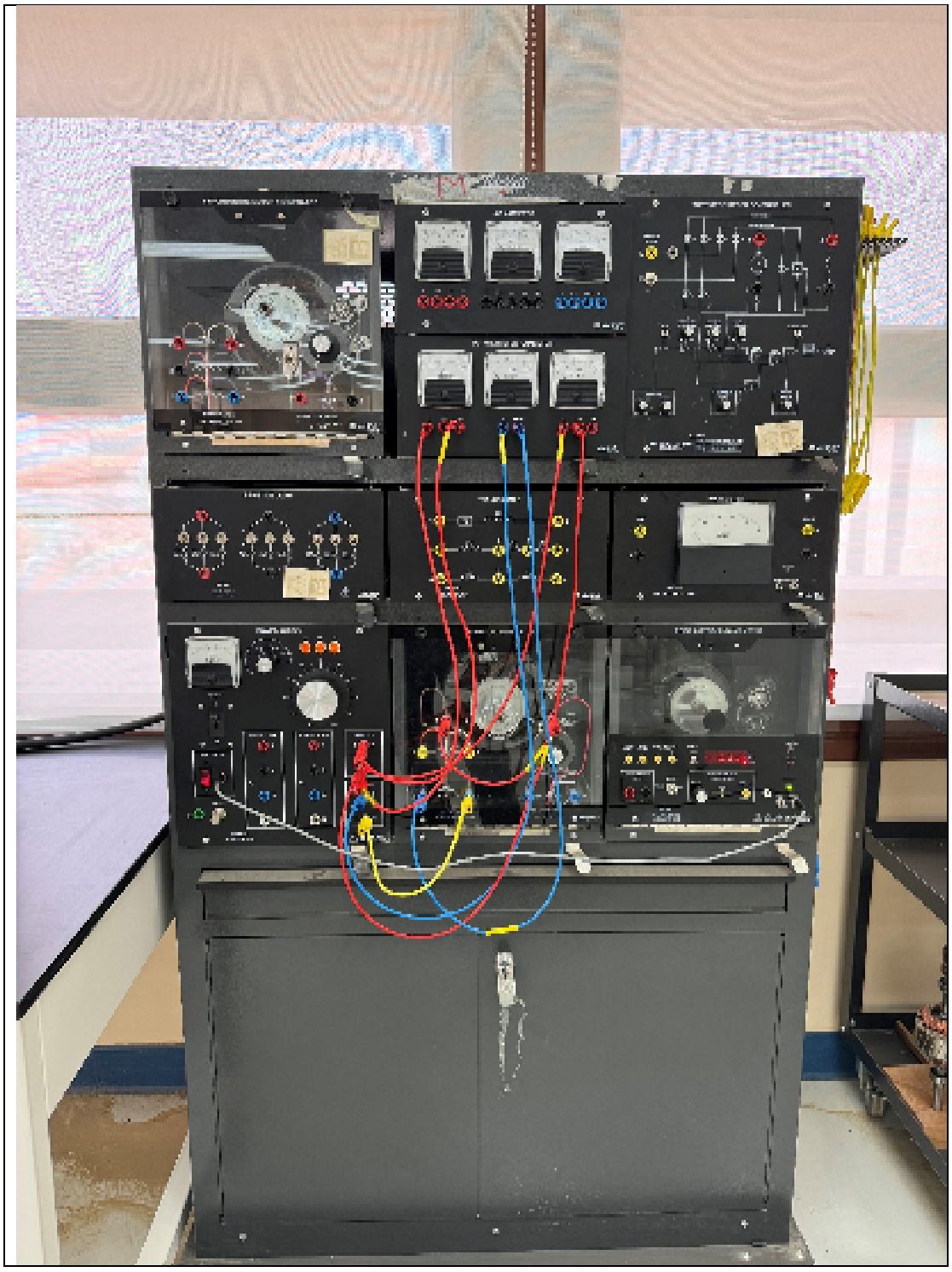
Digital Tachometer

Timing Belt

Pulley

Connection Leads

Prime Mover/ Dynamo.



Electrical Research Lab – B15-1-005

The Research Lab in electrical engineering department is equipped with advanced tools like the MicroLabBox 1202 and dSPACE 1104, providing a robust platform for cutting-edge research in control systems, real-time simulation, and hardware-in-the-loop (HIL) testing. The MicroLabBox 1202 is a versatile, all-in-one development system designed for rapid prototyping and testing of control algorithms, offering high computational power and a wide range of I/O interfaces. Complementing this, the dSPACE 1104 provides real-time processing capabilities, making it ideal for developing and testing complex control strategies. Together, these systems enable researchers and students to model, simulate, and implement sophisticated control applications, bridging the gap between theoretical research and practical implementation.

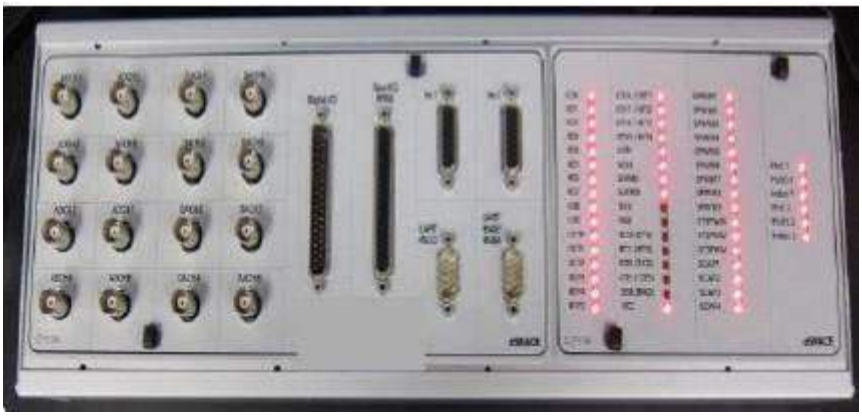
Objective

The objectives of the Research Lab in the Electrical Engineering Department are listed below:

- **To develop proficiency in control system research:** Provide a platform for researchers and students to engage in advanced studies in electrical and electronics control systems, enabling the development, testing, and validation of complex control algorithms.
- **Facilitate Real-Time Simulation and Testing:** Utilize the MicroLabBox 1202 and dSPACE 1104 systems to conduct real-time simulations, helping users model and predict system behaviour under realistic conditions.
- **Enable Hardware-in-the-Loop (HIL) Testing:** Bridge the gap between theoretical models and physical implementation by allowing HIL testing, which integrates real hardware with simulated environments for more accurate and practical testing.
- **Support Rapid Prototyping and Algorithm Development:** Use the MicroLabBox 1202's computational power and diverse I/O interfaces to quickly design, prototype, and test new control algorithms, accelerating the research process.
- **Promote Practical Application of Theoretical Knowledge:** Encourage researchers and students to apply theoretical control concepts in a practical, hands-on environment, reinforcing understanding through experimentation.
- **Enhance Research and Innovation Capabilities:** Provide a cutting-edge research environment that supports innovation in control applications, preparing students and researchers to tackle complex, real-world challenges in engineering.
- **Strengthen Skills in Real-Time Processing:** Utilize dSPACE 1104's real-time processing to train students in the development of control strategies that are directly applicable to dynamic, real-time systems.

Equipment Used

MicroLabBox 1202 and dSPACE 1104 systems with renewable PV panels and wind turbine system



Electronic Circuits Laboratory – B15-1-006

The Electronic Circuits Laboratory equips students with practical skills in using essential electrical instruments such as multimeters, function generators, power supplies, and oscilloscopes (CRO). It reinforces theoretical concepts through hands-on experiments, emphasizing accurate data recording and safety practices. The lab prepares students for advanced electrical engineering applications.

Objective

The objective of the Electronic Circuits Laboratory is to equip students with essential hands-on skills and knowledge in using fundamental electrical and electronic equipment such as multimeters, function generators, power supplies, and oscilloscopes (CRO). The lab aims to:

- Familiarize students with the operation and safe handling of electrical instruments.
- Develop awareness of the operational limits of components and devices to ensure responsible usage.
- Reinforce theoretical concepts from prerequisite courses (EE 211 and EE 221) through practical application.
- Enhance students' ability to accurately record experimental data and communicate their observations and findings effectively.
- Instill safety-conscious practices during lab activities.
- Provide practical exposure that supports learning objectives of related courses, including Electrical Circuit Lab and Electronics Devices Lab.

Common Experiments

Basic Measurements and Basic Laws (Ohms Law, KVL and KCL), Theorems of Electric Circuit Analysis, Measurement of AC Circuit Parameters, Resonance, Transient Analysis, Rectifiers & Characteristics of Silicon Diodes, Diode Clippers, Voltage Stabilization with Zener Diode, Half-Wave Rectifier, Full-Wave Bridge Rectifier, Current Control Characteristic curve of transistor BJT, Output Characteristic curve of transistor, Common-Emitter Amplifier, Output Characteristic curve of transistor JFET

Equipment Used

Master unit, DC power supply (12 V, 0-12V DC), Digital Multimeter, Digital Function Generator, Cathode Ray Oscilloscope (CRO) and Discrete components

HIGH VOLTAGE LAB –B15-P-002

A **High Voltage Laboratory** is an advanced facility where students and researchers study the behavior, testing, and insulation of high-voltage systems and components. This laboratory plays a critical role in electrical engineering, especially in the fields of power transmission, distribution, and high-voltage equipment manufacturing. Equipped with specialized apparatus like impulse generators, AC and DC high-voltage sources, and insulation testing equipment, the lab enables hands-on learning and experimentation under controlled high-voltage conditions.

In the High Voltage Laboratory, students can safely study phenomena such as corona discharge, partial discharges, breakdown voltage, and insulation properties. It also allows for testing and analysis of electrical components such as insulators, cables, transformers, and switchgear. With these capabilities, the lab prepares students to work on high-voltage systems in industries such as power generation, transmission, and electrical equipment design.

Objectives:

- Understanding High-Voltage Fundamentals
- Testing of High-Voltage Equipment
- Insulation Testing and Analysis
- Study of High-Voltage Phenomena
- Safety Practices in High-Voltage Environments
- Measurement and Data Analysis Skills
- Research and Innovation in High-Voltage Applications
- Industry-Relevant Skill Development

Common Experiments:

1. Generate and measure High Voltage
2. Evaluate the Breakdown voltage between two spheres
3. Evaluate the break down voltage between sphere-cone and Cone- Plate.
4. Calculate the DC High Voltage and ripple voltage
5. Generate and Measure the Impulse voltage

Equipment Used:

Control Panel

AC Peak voltmeter Digital

Digital DC Voltmeter

Digital Impulse Voltmeter

Single phase AC Voltage Test Transformer

Earthing Rod

Connecting Rod

Connecting cup

Floor Pedestal

HV Silicon Rectifier

Impulse Capacitor

Measuring resistor

Earthing switch

Spacer Tube

Load Capacitor

Charging resistor

Wave resistor Front

Wave resistor Tail

Insulating Rod

Sphere Gap

Electrical Drive for sphere

DC Load Resistor

Low Voltage Divider

Optical Trigger Cable

Electrical Trigger Cable

Measuring Spark gap for AC, DC and Impulse

Spacer bar

Oil Testing Cup for AC and DC

Top electrode

Measuring Capacitor

Safety Cage for Stage

Safety Door Bulb

LOGIC DESIGN LAB – B151-029

Objectives:

The Logic Design Lab experiments cover the experimental implementation of the theoretical concepts included in the theory course Logic Design (313-EE-3). In general, include:

- Recognize and understand basic logic gates and design it.
- Outline effectively the design procedure of logic circuits and relate the obtained results with the theoretical concepts.
- Design and interpret various sequential circuits such as counters, shift registers and memory units.

Common Experiments:

- Logic gates.
- Adders and Subtractors.
- Encoder and Decoder.
- Multiplexer & De-Multiplexer.
- Flip-Flops and Counters.
- Shift Registers and Memory Units.

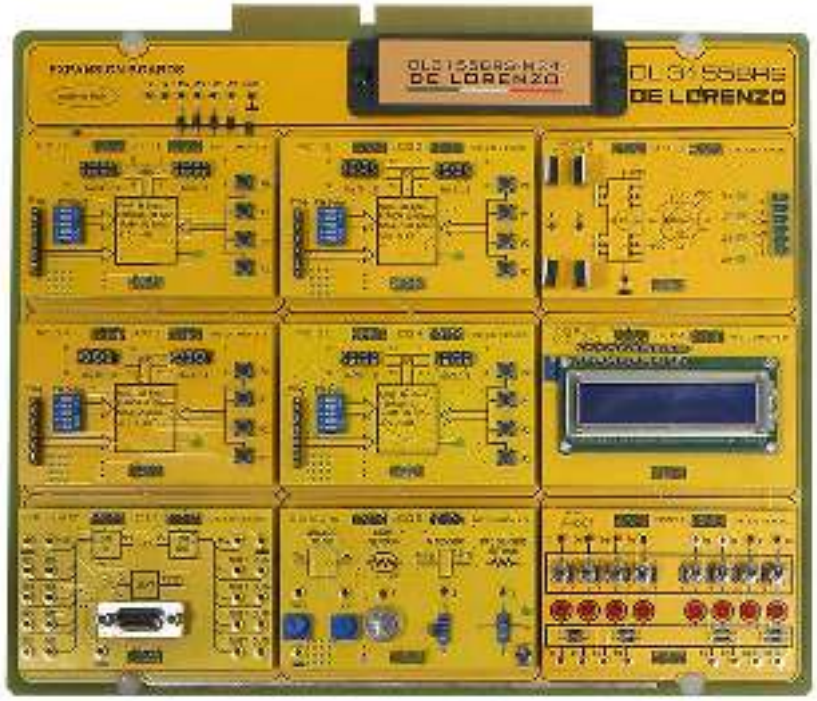
Equipment Used:

- Master Module
- Different Experiments Kits

Microprocessors and Microcontrollers Lab

Building: B15, Room: 1-1-011

The **Microprocessor and Microcontroller Lab** is an advanced facility designed to equip students with essential skills in electronic circuit design and microcontroller programming, critical for **Electrical, Electronic Engineering** and **Computer Engineering** fields. It features two sophisticated systems: the **DL3155BRS-M24 Microcontroller Kit** and the **DL 3155E24R 32-Bit Microprocessor Module**. The DL3155BRS-M24 enables hands-on exploration of microcontroller fundamentals through exercises involving digital I/O, sensor integration, A/D and D/A conversions, memory manipulation, motor control, and opto-isolated I/O, supported by modular mini boards like PIC 16, PIC 18, PIC 24, and PIC 32. In parallel, the DL 3155E24R provides an immersive environment for understanding 32-bit microprocessor properties using the **Cortex-M3** architecture, emphasizing software development, system properties, and real-world problem-solving. Together, these systems offer a comprehensive, hands-on learning experience, bridging theoretical concepts with practical application and preparing students for advanced roles in electronic and embedded system design.



MICROPROCESSOR AND MICRO CONTROLLER LAB – B15-1-1-011

The Microprocessor and Microcontroller Lab provides students with hands-on experience in microprocessor and microcontroller systems, integrating academic knowledge with practical application. This dynamic learning environment prepares students for electronics and embedded systems, fostering an inquiry and experimentation culture. It prepares students for technological, innovative, and problem-solving challenges in a rapidly changing sector.

Objectives:

- Understanding Assembly Language Programming.
- Familiarization with MASM (Microsoft Assembler)
- Understand the architecture and operation of microprocessors and microcontrollers.
- Learn programming techniques for embedded systems.
- Develop skills in interfacing peripherals with microcontrollers.
- Conduct experiments that demonstrate real-world applications of microprocessors and microcontrollers.

Common Experiments:

- Basic Assembly Language Programming; Addition, subtraction and division of 8-bit and 16 bit numbers, Stack memory;
- 7 Segment Display; LCD Control, Interfacing with Peripherals
- Application module includes Numeric Display and Traffic Light Module.

Equipment Used: MASM (16-bit) , DL 3155E24R (32-bit Microprocessor Module), DL3155BRS-M24 Microcontroller Kit, Microprocessor/ Microcontroller Application Module.

MICROPROCESSOR AND MICRO CONTROLLER LAB – B15-1-1-011






Power System Lab – B15-1-013

The "Power System Laboratory" in the Department of Electrical Engineering is a state-of-the-art facility designed to provide hands-on experience in electrical power engineering. Equipped with advanced didactic benches, industrial-grade hardware, and an open SCADA software platform, the lab supports comprehensive learning across four major study areas: electric power generation, transmission and distribution, power utilization, and protection techniques. Students engage with real-world simulations of power systems, gaining skills in system monitoring, control, fault analysis, and optimization. Emphasizing safety and efficiency, the lab prepares students for practical challenges in power engineering, fostering both technical competencies and innovation.

Objective

The focus of the power system lab is to enable students to gain hands-on experience in electrical power engineering through interaction with advanced didactic benches, industrial-grade hardware, and SCADA software. Here are the objectives for the Power System Lab:

- To provide practical experience in power system engineering.
- To develop skills in power generation, transmission, distribution, and utilization.
- To enhance competence in power system monitoring and control.
- To enable fault analysis and optimization of power systems.
- To foster technical skills in SCADA and industrial hardware usage.
- To prepare students for real-world challenges in power engineering.

Common Experiments

Response of alternator in isolated operation, synchronization issues, power system protection, Generator open circuit, short circuit test, load characteristics, three phase symmetrical short circuit, Transmission lines protection, Double Bus bar systems coupling, protection in parallel connected lines, Power system protection, Transformer protection.

Equipment Used

Power Generation Setup (DL GTU101-S), Power Generation Protection Expansion Modules (DL GTU101-P), Power Transmission And Distribution (DL GTU102-S), Three Phase Transformer (DL GTU102.1-S), Transmission Lines (DL GTU102.2-S), Bus Bar (DL GTU102.3-S). Three Phase Transformer (DL GTU102.1-S).