# COURSE OVERVIEW EE0422
# Electrical Engineering Principles

**Course Title**
Electrical Engineering Principles

**Course Date/Venue**
July 13-17, 2025/Meeting Plus 9, City Centre Rotana, Doha, Qatar

**Course Reference**
EE0422

**Course Duration/Credits**
Five days/3.0 CEUs/30 PDHs

**Course Description**

***This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt in the class will be applied using our state-of-the-art simulators.***

This course is designed to provide participants with a detailed and up-to-date knowledge on electrical engineering principles. It covers the electrical concepts of electrical engineering; the fundamental concepts of voltage, current, resistance and power; the basic circuit elements and circuit analysis techniques; the series and parallel resistor circuits and node-voltage and mesh-current methods for circuit analysis; the Thevenin's and Norton's theorems for simplifying complex circuits; and the alternating current (AC) and sinusoidal waveforms, AC circuits, phasors and complex numbers.

During this interactive course, participants will learn the impedance and admittance concepts for circuit analysis and power calculations in AC circuits; the IECC/IEEE standards, power generation, transmission and distribution systems; the power systems components, power factor correction, reactive power compensation, smart grids and renewable energy integration; the modern power system components, electromagnetic theory and transformers; the all types of tests for power transformers; modifying old transformer and classifying protective relays; the tripping devices, circuit breakers, earthing system and standard requirement; the control systems, digital electronics, power quality and insulation; the general principles to hazardous area classification; and the analog and digital communication systems.

## Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain a good working knowledge on electrical engineering principles
- Discuss the electrical concepts of electrical engineering including the fundamental concepts of voltage, current, resistance, and power
- Identify basic circuit elements and apply circuit analysis techniques
- Analyze series and parallel resistor circuits and carryout node-voltage and mesh-current methods for circuit analysis
- Review Thevenin's and Norton's theorems for simplifying complex circuits
- Discuss alternating current (AC) and sinusoidal waveforms as well as analyze AC circuits using phasors and complex numbers
- Carryout impedance and admittance concepts for circuit analysis and power calculations in AC circuits
- Recognize IECC/IEEE standards, power generation, transmission and distribution systems including power systems components, power factor correction, reactive power compensation, smart grids and renewable energy integration
- Identify modern power system components, electromagnetic theory and transformers
- Carryout all types of tests for power transformers, modify old transformer, apply transformer protection and classify protective relays
- Recognize tripping devices, circuit breakers, earthing system and standard requirement
- Identify control systems, digital electronics, power quality and insulation
- Discuss the general principles to hazardous area classification including analog and digital communication systems

## Exclusive Smart Training Kit - H-STK®


*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

## Who Should Attend

This course provides an overview of all significant aspects and considerations of electrical engineering principle for electrical engineers, plant engineers, mechanical engineers, process engineers, maintenance engineers, facilities managers, facility professionals and other technical staff.

**Course Certificate(s)**

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours

**Certificate Accreditations**

Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

## Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

**Mr. Herman Eksten (Theunis Hermanus Eksteen)**, PE, PgDiP, is a **Senior Electrical**, **Instrumentation & Control Engineer** with over **40 years** of extensive experience within the **Petrochemical**, **Oil & Gas** and **Power** industries specializing in **Check System Equipment** for Field Operator, **Inspect Equipment** for Defects & Submit Reports, **Evaluate Equipment** Conditions & File Reports, **Conduct Equipment** Inspection & Reporting, Identify **Equipment Malfunctions & Prepare Reports**, **System Defect** Analysis & Reporting, Monitor & Report on **Equipment Deficiencies**, **Perform Equipment** Checks & Submit Reports, **Control Systems**, Programmable Logic Controllers (**PLC**), **SCADA System**, **PLC & SCADA** - Automation & Process Control, **PLC & SCADA** Systems Application, Technical **DCS/SCADA**, **PLC-SIMATIC S7 300/400**: Configuration, Programming and Troubleshooting, **PLC, Telemetry and SCADA** Technologies, Cyber Security of Industrial Control System (**PLC, DCS, SCADA & IED**), Basics of **Instrumentation Control System, DCS**, **Distributed Control System** - Operations & Techniques, Distributed Control System (**DCS**) Principles, Applications, Selection & Troubleshooting, Distributed Control Systems (**DCS**) especially in **Honeywell DCS**, **H&B DCS**, **Process Control & Safeguarding**, **Field Instrumentation**, **Instrumented Protective Devices** Maintenance & Testing, Instrumented Protective Function (**IPF**), **Refining & Rotating Equipment** and Distributed Control Systems (**DCS**). Further, he is also well-versed in **Electrical Safety**, Certified **HV Electrical Safety**, **Low Voltage Electrical Safety**, **Electrical Circuits**: Series and Parallel Connection, **Electrical Faults & Protective Devices**, Risk Control Methods, **LOTO – Breakers** Operation in Electricity Substation, **LOTO** Principles and Procedures, **Arc Flash Risk Assessment**, Safety in **Power Electronic Equipment & Lasers**, **Circuit Breakers & Switchgears**, **Switchgear Assets Management**, **Circuit Breakers Control Circuits**, **Substation Maintenance** Techniques, **High Voltage Operation, Electrical Protection**, **Overhead Lines & Substation**, **Power Supply**, **High Voltage Substation**, **Electrical Protection Design**, **Earthing & Lightning Protection Design, Underground Equipment**, **Distribution Network Maintenance & Construction**, **Transformers Operation & Maintenance**, **Electric Power System, Power Plant Management**, **Substation Commissioning & Troubleshooting**, **Cable Splicing & Termination, Electrical Installation & Maintenance**, **Power Generation Operation & Control, Switchgear Life Assessment**, **Structured Cabling, Electric Power System, Power System Stability, Power System Planning & Economics**, **Power Flow** Analysis, **Combined Cycle Power Plant**, **UPS & Battery System, Variable Speed Drives,** and **HV Motors & Transformers**. He is currently the **Lead Electrical Engineer** of **SNC-LAVALIN** wherein he is responsible for basic designs and successful implementation of electrical engineering to plant overhead lines and substations.

During his career life, Mr. Eksten held various positions such as the **Lead Electrical Engineer**, **Operations Manager**, **Project Engineer**, **Technical Specialist**, **Customer Executive**, **District Manager**, **Instrumentation Engineer**, **Electrical Protection Specialist**, **High-Voltage Operator** and **Apprentice Electrician** for FOX Consulting, UHDE (ThyssenKrupp Engineering), TWP Projects/Consulting (EPMC-Mining), ISKHUS Power, Rural Maintenance (PTY) Energia de Mocambique Lda., Vigeo (PTY) Ltd and ESKOM.

Mr. Eksten is a **Registered Professional Engineering Technologist** and has a Postgraduate Diploma in Management Development Programme and a National Higher Diploma (NHD) in Electrical Power Engineering. Further, he is a **Certified Instructor/Trainer**, a Senior member of the South African Institute Electrical Engineers (**SAIEE**) and holds a Certificate of Registration Membership Scheme from the Engineering Council of South Africa (**ESCA**). He has further delivered numerous trainings, courses, seminars, workshops and conferences internationally.

## Course Fee

**US$ 6,000** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

## Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

## Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

## Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

***Day 1:*** ***Sunday, 13th of July 2025***

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| *0730 – 0800* | *Registration & Coffee* |
| *0800 – 0815* | *Welcome & Introduction* |
| *0815 – 0830* | ***PRE-TEST*** |
| *0830 – 0930* | ***Introduction to Electrical Engineering – Refresh of Electrical Concepts***<br>*Electrical Engineering and its Applications • Fundamental Concepts: Voltage, Current, Resistance, and Power • Basic Circuit Elements: Resistors, Capacitors, and Inductors • Transient Analysis in RL and RC Circuits • Circuit Analysis Techniques: Ohm's Law, Kirchhoff's Laws, and Voltage/Current Division • Analysis of Series and Parallel Resistor Circuits • Node-voltage and Mesh-Current Methods for Circuit Analysis • Thevenin's and Norton's Theorems for Simplifying Complex Circuits* |
| *0930 – 0945* | *Break* |
| *0945 – 1100* | ***AC Circuits***<br>*Alternating Current (AC) and Sinusoidal Waveforms • Analysis of AC Circuits using Phasors and Complex Numbers • Impedance and Admittance Concepts for Circuit Analysis • Power Calculations in AC Circuits: Real Power, Reactive Power, and Apparent Power - Impedance and Admittance Concepts for Circuit Analysis • Power Calculations in AC Circuits: Real Power, Reactive Power and Apparent Power* |
| *1100 – 1215* | ***Power Systems***<br>*IECC/IEEE Standards - Power Generation, Transmission, and Distribution Systems • Power System Components: Generators, Transformers, Transmission Lines and Distribution Networks* |
| *1215 – 1230* | *Break* |
| *1230 – 1420* | ***Power Systems (cont'd)***<br>*Power Factor Correction and Reactive Power Compensation • Smart Grids and Renewable Energy Integration* |
| *1420 – 1430* | ***Recap*** |
| *1430* | *Lunch & End of Day One* |

**Day 2: Monday, 14th of July 2025**

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| 0730 – 0930 | ***Overview of Modern Power System Components***<br>*Structure of the Electrical Power System • Generating Units - Synchronous Generators, Exciters and Automatic Voltage Regulators, Turbines and their Governing Systems • Substations - Types of Modifications* |
| 0930 – 0945 | *Break* |
| 0945 – 1115 | ***Electromagnetic Theory***<br>*Electromagnetic Fields and Maxwell's Equations • Electrostatics and Magnetostatics: Electric and Magnetic Fields, Gauss's Law, Ampere's Law • Electromagnetic Induction: Faraday's Law, Lenz's Law, and Inductance* |
| 1115 – 1230 | ***Transformers***<br>*Transformer Theory and Principles • Generator Transformers - Power Transformers • Distribution Transformers • Dry Type Transformers • Transformer Connections • Loading Power Transformers • Transformer Installation and Maintenance • Problem and Failure Investigations • On-line Monitoring of Liquid-Immersed Transformers* |
| 1230 – 1245 | *Break* |
| 1245 – 1420 | ***All Types of Test for Power Transformers***<br>*Instrument Transformers – Current & Voltage Transformers ● Tap Changers ● De-Energized Tap Changers (DETC) ● Load Tap Changers(OLTC) & Controls ● Built-on Protections (Buchholz & Similar Relays) ● Cooling Systems ● Fire Fighting* |
| 1420 – 1430 | ***Recap*** |
| 1430 | *Lunch & End of Day Two* |

**Day 3: Tuesday, 15th of July 2025**

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|---|---|
| 0730 – 0830 | ***Transformer Modification of Old Transformer***<br>*Commissioning Procedures for New and Renewal of Transformers • Transformer Protection - Basic Overview of System Protection • Instrument* |
| 0830 - 0930 | ***Transformers Protection***<br>*Relays • Time Grading Principles • Practical Examples • AC Circuits • High Voltage/Low Voltage/ Relays/ Switchgears Unit Protection • Transformer Protection • The Protection of Synchronous • Generators • Transmission Line Protection* |
| 0930 – 0945 | *Break* |
| 0945 – 1115 | ***Protection Relays***<br>*Introduction to Protection ● Protection Relays (History; Construction and Principles of Operation; Modern Technology) ● Classification of Protection Relays and Codes -Main Protection and Back-up Protection ● Intelligent Electronic Devices (IED's) ● Fuses (Characteristics, Applications and Special Cares) ● Examples and Exercises* |
| 1115 – 1230 | ***Tripping Devices – Circuit Breakers***<br>*The Mechanism of Electric Arc Breakdown ● Types of Circuit Breakers and Applications (LV, MV and HV) - Main Characteristics ● Operating Mechanism, Tripping Circuits and Control Systems ● Metal Clad Switchgear Maintenance Details - SF6 Circuit Breaker - Examples* |
| 1230 – 1245 | *Break* |
| 1245 – 1420 | ***Earthing System & Standard Requirement***<br>*Solid, Impedance and Ungrounded Systems ● The Implications of Various Grounding Techniques on System Performance ● Earth Grid and Calculations ● Touch and Step Potentials ● Examples* |
| 1420 – 1430 | ***Recap*** |
| 1430 | *Lunch & End of Day Three* |

**Day 4: Wednesday, 16th of July 2025**

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|---|---|
| 0730 – 0930 | ***Control Systems***<br>*Control Systems and Feedback Principles • Transfer Function Representation of Systems* |
| 0930 – 0945 | *Break* |
| 0945 – 1115 | ***Control Systems (cont'd)***<br>*Block Diagram and Signal Flow Graph Representation • Stability Analysis and Stability Criteria* |
| 1115 – 1230 | ***Digital Electronics & Control Systems***<br>*Industrial UPSs • Programmable Logic Controllers (PLCs) - Control Systems and Feedback Principles - Block Diagram and Signal Flow Graph Representation • Stability Analysis and Stability Criteria - Batteries* |
| 1230 – 1245 | *Break* |
| 1245 – 1420 | ***Power Quality***<br>*Wiring and Grounding for Power Quality • Harmonics in Power Systems • Voltage Sags • Voltage Fluctuations and Lamp Flicker in Power Systems • Power Quality Monitoring* |
| 1420 – 1430 | ***Recap*** |
| 1430 | *Lunch & End of Day Four* |

**Day 5: Thursday, 17th of July 2025**

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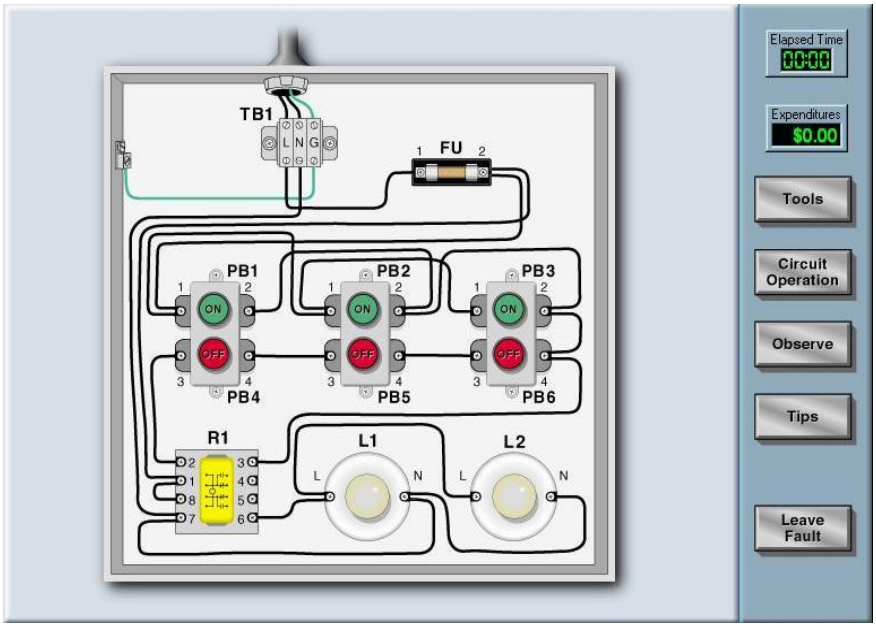
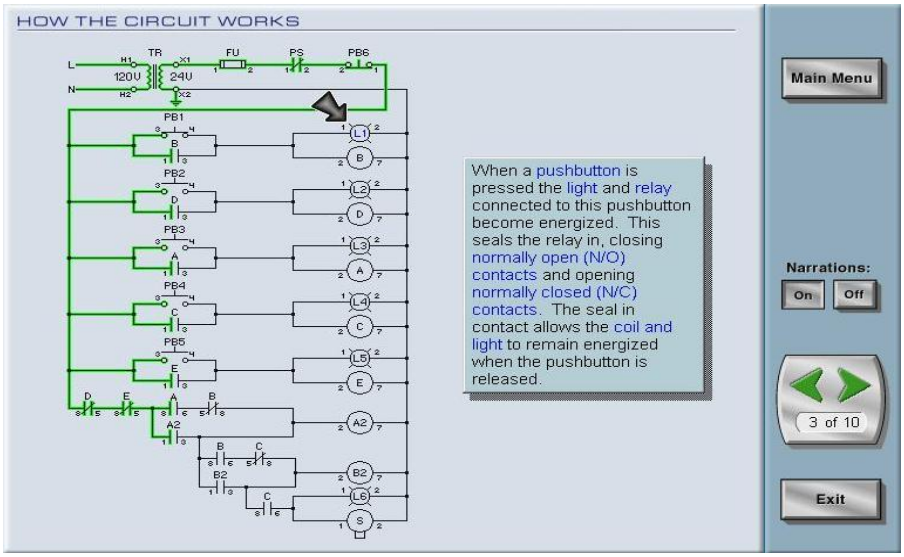
|---|---|
| 0730 – 0930 | ***Insulation***<br>*Materials ● Insulation Measurement Methods ● Heat, Lightning Surge and Transients Effects on Insulation ● Insulation System Construction ● Modes of Degradation ● Ohm's Law ● Leakage Current ● Polarization Current ● Selecting Test Voltages ● Spot Readings ● Dielectric Absorption Test ● Polarization Index* |
| 0930 – 0945 | *Break* |
| 0945 – 1045 | ***General Principles/Introduction to Hazardous Area Classification***<br>*Defining Hazardous Areas (Zoning) - EN 60079-10 ● ATEX 137 ● API 500 ● Typical Gas Hazard ● API RP 505 ● IEEE ● ISA - Methods of Explosion Protection* |
| 1045 – 1215 | ***Communication Systems***<br>*Analog and Digital Communication Systems • Modulation Techniques: Amplitude Modulation (AM), Frequency Modulation (FM), and Pulse Modulation* |
| 1230 - 1245 | *Break* |
| 1245 – 1345 | ***Communication Systems (cont'd)***<br>*Telecommunications Networks and Protocols • Basics of Wireless Communication Systems: Cellular Networks, Wi-Fi, and Bluetooth* |
| 1345 – 1400 | ***Course Conclusion***<br>*Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course* |
| 1400 – 1415 | ***POST-TEST*** |
| 1415 – 1430 | *Presentation of Course Certificates* |
| 1430 | *Lunch & End of Course* |

**Simulator (Hands-on Practical Sessions)**

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulators "Troubleshooting Electrical Circuits V4.1", Power World" and "ETAP software".

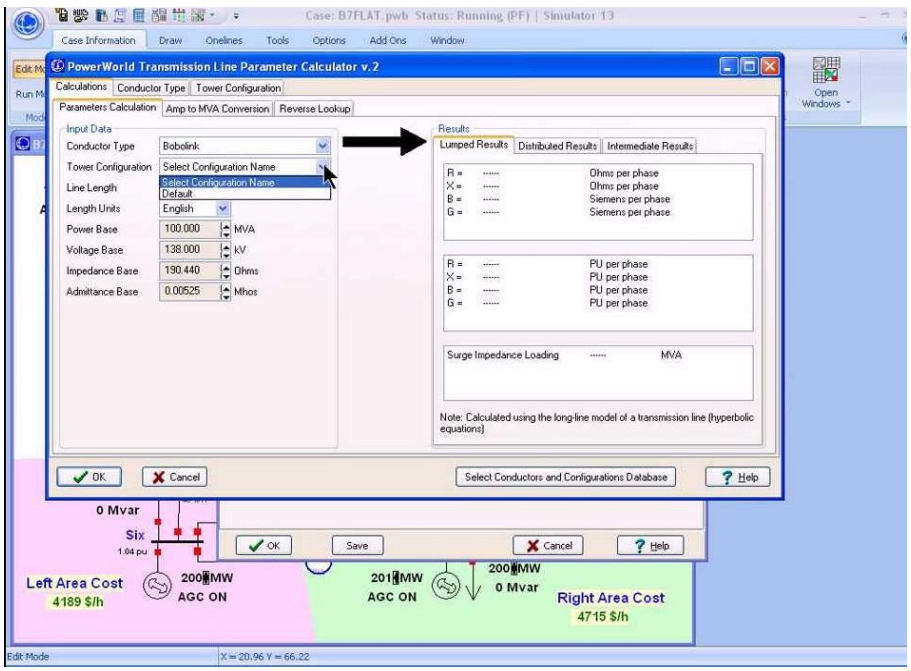



**Basic Techniques**

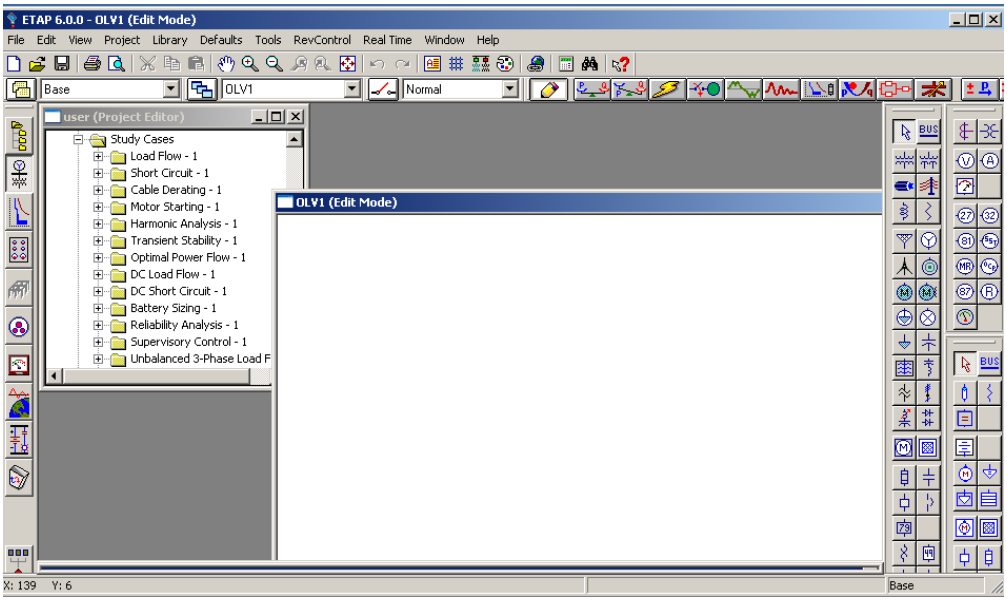



**Basic Control Circuits**


**Motor Control Techniques**




**Power World Simulator**




**ETAP Software Simulator**

**Course Coordinator**

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