COURSE OVERVIEW IE0102
Motor Actuator and Control Applications (Theory and Practical)

Course Title
Motor Actuator and Control Applications (Theory and Practical)

Course Date/Venue
Session 1: May 19-23, 2025/Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: December 15-19, 2025/Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
IE0102

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 will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Motor Actuator and Control Applications. It covers the motor actuators, principles of electromechanical energy conversion; the fundamentals of motor control and key components in motor control systems; the motor and control system specifications and the principles of DC motors; the DC motor control techniques, robotics and automation, automotive applications and industrial machinery; troubleshooting and maintaining DC motors through identifying common faults, testing and diagnostics, maintenance schedules and replacement procedures; and the types of AC motors, construction and operation, rotating magnetic field principles and torque-speed characteristics.

Further, the course will also discuss the AC motor control techniques covering variable frequency drives (VFDs), soft starters and dynamic braking, speed and torque control and power factor correction; the AC motors applications for HVAC systems, industrial conveyors, pumping systems and renewable energy systems; the common faults in AC motors; the proper AC testing tools and procedures, predictive maintenance techniques and repair and replacement; the working principles of servo motors and closed-loop position; and the speed control, control systems for servo applications and comparison with stepper motors.

During this interactive course, participants will learn the stepper motor operation and types and microstepping techniques; the control methods for precision motion and common applications and limitations; the advanced control algorithms and integration of sensors in motor control; the integration of motor control in systems and energy efficiency and sustainability including internet of things (IoT) in motor control; the safety standards, hazard prevention in motor systems and regulatory compliance in different industries; and the documentation and reporting best practices.

Course Objectives

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

- Apply and gain an in-depth knowledge on motor actuator and control applications
- Discuss motor actuators, principles of electromechanical energy conversion, fundamentals of motor control and key components in motor control systems
- Recognize motor and control system specifications and the principles of DC motors
- Apply DC motor control techniques, robotics and automation, automotive applications and industrial machinery
- Troubleshoot and maintain DC motors through identify common faults as well as testing and diagnostics, maintenance schedules and replacement procedures
- Identify the types of AC motors, construction and operation, rotating magnetic field principles and torque-speed characteristics
- Carryout AC motor control techniques covering variable frequency drives (VFDs), soft starters and dynamic braking, speed and torque control and power factor correction
- Explain AC motors applications for HVAC systems, industrial conveyors, pumping systems and renewable energy systems
- Identify the common faults in AC motors and apply proper AC testing tools and procedures, predictive maintenance techniques and repair and replacement
- Recognize the working principles of servo motors, closed-loop position and speed control, control systems for servo applications and comparison with stepper motors
- Identify stepper motor operation and types and apply microstepping techniques, control methods for precision motion and common applications and limitations
- Apply advanced control algorithms and integration of sensors in motor control
- Integrate motor control in systems and apply energy efficiency and sustainability including internet of things (IoT) in motor control
- Review safety standards, hazard prevention in motor systems, regulatory compliance in different industries and documentation and reporting best practices

Who Should Attend

This course provides an overview of all significant aspects and considerations of motor actuator and control applications for industrial engineers, technical engineers, instrumentation engineers, electrical engineers and other technical staff.

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**.*

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 Fee

US$ 5,500 per Delegate + **VAT**. 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.

Course Certificate(s)

(1) Internationally recognized Competency Certificates and Plastic Wallet Cards will be issued to participants who completed a minimum of 80% of the total tuition hours and successfully passed the exam at the end of the course. Certificates are valid for 5 years.

Recertification is FOC for a Lifetime.

Sample of Certificates

The following are samples of the certificates that will be awarded to course participants:-

(2) Official Transcript of Records will be provided to the successful delegates with the equivalent number of ANSI/IACET accredited Continuing Education Units (CEUs) earned during the course.

Haward Technology Middle East

Continuing Professional Development (HTME-CPD)

CEU Official Transcript of Records

TOR Issuance Date: 15-Nov-23

HTME No. 74851

Participant Name: Waleed Al Habeeb

Program Ref.	Program Title	Program Date	No. of Contact Hours	CEU's
IE0102	Motor Actuator and Control Applications (Theory and Practical)	November 11-15, 2023	30	3.0

Total No. of CEU's Earned as of TOR Issuance Date **3.0**

TRUE COPY

Jaryl Castillo
Academic Director

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

P.O. Box 26070, Abu Dhabi, United Arab Emirates | Tel.: +971 2 3091 714 | E-mail: info@haward.org | Website: www.haward.org

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:

Dr. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electrical & Instrumentation Engineer** with over **35 years** of extensive experience in the **Power**, **Petroleum**, **Petrochemical** and **Utilities**. He specializes in **HV/LV Equipment**, **High Voltage Electrical Safety**, **LV & HV Electrical System**, **HV Equipments Inspection & Maintenance**, **HV Switchgear Operation & Maintenance**, **LV Distribution Switchgear & Equipment**, **HV Switchgear Maintenance**, **HV/LV Electrical** Authorisation, **Hazardous Area Classification, Power Quality**, **Disturbance Analysis**, **Blackout**, **Power Network**, **Power Distribution**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, **ETAP**, Electrical **Substations**, Tariff Design & Structure Analysis, **Engineering Drawings, Codes & Standards**, **P&ID Reading, Interpretation & Developing**, **PLC**, **SCADA**, **DCS**, **Process Control**, **Instrumentation**, **Automation**, Power **Generation**, **Process Control Instrumentation**, **SIS**, **SIL**, **ESD**, **Alarm Management Systems**, **Fieldbus Systems** and **Fiber Optics** as well as the service pricing of these. He is currently the **Systems Control Manager** of **Siemens** where he is in-charge of Security & Control of Power **Transmission Distribution** & **High Voltage** Systems and he further takes part in the Load Records Evaluation & Transmission Services Pricing.

During his career life, Dr. Ahmed has been actively involved in different Power System Activities including Roles in Power System Planning, Analysis, Engineering, **HV Substation** Design, Electrical Service Pricing, Evaluations & Tariffs, Project Management and also in Teaching and Consulting. His vast industrial experience was honed greatly when he joined many International and National Companies such as **Siemens**, **Electricity Authority** and **ACETO** industries where he focused more on dealing with Technology Transfer, System Integration Process and Improving Localization. He was further greatly involved in manufacturing some of **Power System** and **Control & Instrumentation Components** such as Series of Digital Protection **Relays**, MV **VFD**, **PLC** and **SCADA** System with intelligent features.

Dr. Ahmed is well-versed in different electrical and instrumentation fields like Load Management Concepts, **PLC** Programming, Installation, Operation and Troubleshooting, **AC Drives** Theory, Application and Troubleshooting, Industrial Power Systems Analysis, AC & DC **Motors**, Electric Motor **Protection**, **DCS SCADA**, **Control** and Maintenance Techniques, Industrial Intelligent Control System, **Power Quality** Standards, Power Generators and Voltage Regulators, Circuit Breaker and Switchgear Application and Testing Techniques, **Transformer** and **Switchgear** Application, Grounding for Industrial and Commercial Assets, Power Quality and **Harmonics**, **Protective Relays** (O/C Protection, Line Differential, Bus Bar Protection and **Breaker Failure Relay**) and Project Management Basics (PMB).

Dr. Ahmed has **PhD**, **Master's** & **Bachelor's** degree in **Electrical** and **Instrumentation Engineering** from the **University of Wisconsin Madison**, **USA**. Further, he has numerous papers published internationally in the areas of Power Quality, Superconductive Magnetic Energy Storage, SMES role in Power Systems, Power System **Blackout** Analysis, and Intelligent Load Shedding Techniques for preventing Power System Blackouts, HV **Substation Automation** and Power System Stability.

Course Program

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

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of Motor Actuators*** *Types of Motors (DC, AC, Stepper, Servo) • Applications of Motor Actuators in Various Industries • Advantages and Limitations of Different Motor Types • Future Trends in Motor Actuator Technology*
0930 – 0945	*Break*
0945 – 1030	***Principles of Electromechanical Energy Conversion*** *Basics of Electromagnetic Fields • Faraday's Law of Electromagnetic Induction • Magnetic Circuits and Reluctance • Energy Conversion in Motors*
1030 – 1130	***Fundamentals of Motor Control*** *Definition and Purpose of Motor Control • Open-Loop versus Closed-Loop Systems • Key Control Parameters (Torque, Speed, Position) • Overview of Control Methods (Analog, Digital)*
1130 – 1215	***Key Components in Motor Control Systems*** *Power Supply Requirements • Controllers and Drivers • Sensors and Feedback Systems • Safety Mechanisms*
1215 – 1230	*Break*
1230 – 1330	***Motor & Control System Specifications*** *Torque-Speed Characteristics • Power Ratings and Efficiency • Duty Cycle and Thermal Considerations • Environmental and Operational Constraints*
1330 – 1420	***Hands-On Practical: Introduction to Motor Actuators*** *Identifying Different Types of Motors • Demonstration of Basic Motor Operation • Measuring Torque and Speed • Simple Open-Loop Control Experiment*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Principles of DC Motors*** *Types of DC Motors (Shunt, Series, Compound) • Construction and Operation • Armature Reaction and Commutation • Torque-Speed Characteristics*
0830 – 0930	***DC Motor Control Techniques*** *Voltage and Current Control Methods • PWM (Pulse Width Modulation) Techniques • Speed Control with Feedback • Starting and Braking Methods*
0930 – 0945	*Break*
0945 – 1100	***DC Motor Applications*** *Robotics and Automation • Automotive Applications • Industrial Machinery • Consumer Electronics*
1100 – 1215	***Troubleshooting & Maintenance of DC Motors*** *Common Faults in DC Motors • Testing and Diagnostics • Maintenance Schedules and Best Practices • Replacement Procedures*

1215 – 1230	Break
1230 – 1330	***Hands-On Practical: DC Motor Control*** *Building a PWM-Based Speed Controller • Measuring Performance Parameters • Integrating Sensors for Feedback Control • Troubleshooting Motor Issue*
1330 – 1420	***Case Studies: DC Motor Applications*** *Analysis of Real-World Examples • Challenges Faced in Implementation • Optimization Strategies • Lessons Learned*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Principles of AC Motors*** *Types of AC Motors (Induction, Synchronous) • Construction and Operation • Rotating Magnetic Field Principles • Torque-Speed Characteristics*
0830 – 0930	***AC Motor Control Techniques*** *Variable Frequency Drives (VFDs) • Soft Starters and Dynamic Braking • Speed and Torque Control • Power Factor Correction*
0930 – 0945	Break
0945 – 1100	***Applications of AC Motors*** *HVAC Systems • Industrial Conveyors • Pumping Systems • Renewable Energy Systems*
1100 – 1215	***Troubleshooting & Maintenance of AC Motors*** *Common Faults in AC Motors • Testing Tools and Procedures • Predictive Maintenance Techniques • Repair and Replacement*
1215 – 1230	Break
1230 – 1330	***Hands-On Practical: AC Motor Control*** *Configuring a VFD for Motor Control • Experimenting with Speed and Torque Adjustments • Monitoring Motor Performance • Diagnosing and Fixing Common Issues*
1330 – 1420	***Case Studies: AC Motor Applications*** *Industrial Case Studies • Implementation Challenges and Solutions • Energy Efficiency Improvements • Cost-Benefit Analysis*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Servo Motor Actuators & Control*** *Working Principles of Servo Motors • Closed-Loop Position and Speed Control • Control Systems for Servo Applications • Comparison with Stepper Motors*
0830 – 0930	***Stepper Motor Actuators & Control*** *Stepper Motor Operation and Types • Microstepping Techniques • Control Methods for Precision Motion • Common Applications and Limitations*
0930 – 0945	Break
0945 – 1100	***Advanced Control Algorithms*** *PID Controllers • Fuzzy Logic Control • Model Predictive Control • Adaptive Control Systems*

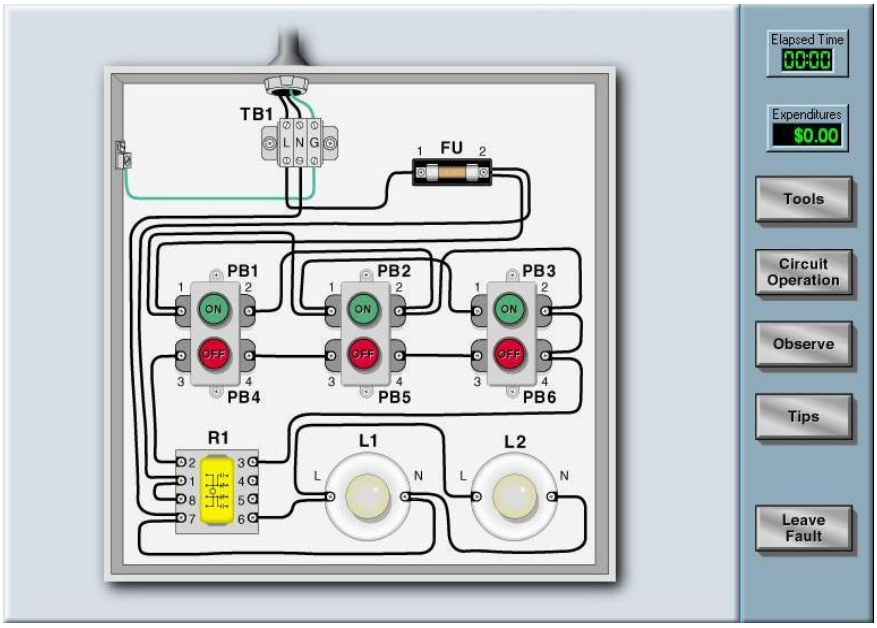
1100 – 1215	***Integration of Sensors in Motor Control*** *Types of Sensors (Encoders, Hall-Effect, Current Sensors) • Role of Sensors in Feedback Systems • Sensor Integration with Microcontrollers • Calibration and Noise Reduction Techniques*
1215 – 1230	*Break*
1230 – 1330	***Hands-On Practical: Advanced Motor Control*** *Implementing PID Control on a Motor • Using Encoders for Position Feedback • Real-Time Monitoring of System Performance • Troubleshooting Advanced Control Systems*
1330 – 1420	***Case Studies: Advanced Motor Applications*** *High-Precision Robotics • Aerospace and Defense Systems • Renewable Energy Integration • Emerging Technologies*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

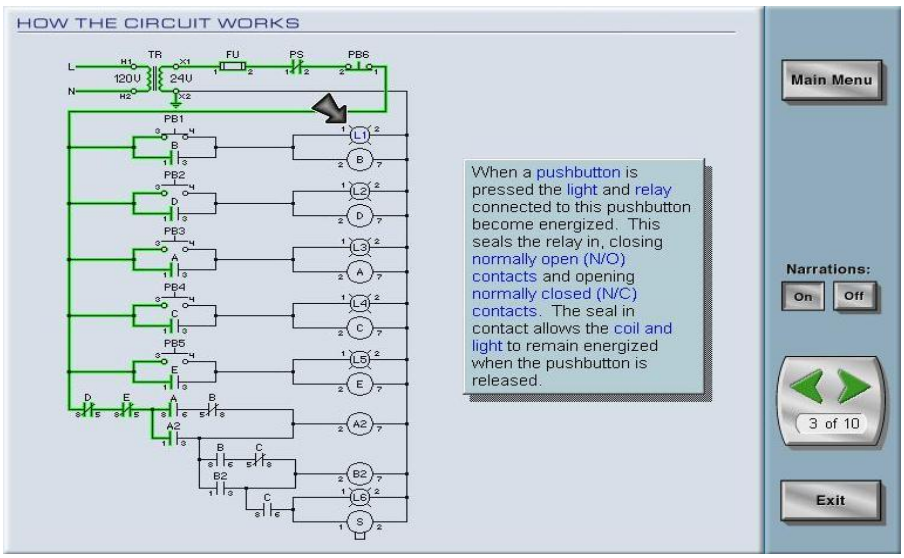
Day 5

0730 – 0830	***Integration of Motor Control in Systems*** *Designing Complete Motor Control Systems • Communication Protocols (CAN, Modbus, Ethernet) • Multi-Motor Synchronization • System-Level Optimization*
0830 – 0930	***Energy Efficiency & Sustainability*** *Energy-Saving Techniques in Motor Control • Role of Motors in Green Technologies • Lifecycle Analysis of Motor Systems • Future of Sustainable Motor Applications*
0930 – 0945	*Break*
0945 – 1100	***Internet of Things (IoT) in Motor Control*** *IoT-Enabled Motor Control Systems • Remote Monitoring and Diagnostics • Predictive Maintenance Using IoT • Challenges and Opportunities*
1100 – 1215	***Safety & Compliance Standards*** *Overview of Safety Standards (IEC, UL, ISO) • Hazard Prevention in Motor Systems • Regulatory Compliance in Different Industries • Documentation and Reporting Best Practices*
1215 – 1230	*Break*
1230 – 1300	***Hands-On Practical: System-Level Integration*** *Building a Complete Motor Control System • Testing and Validating Performance • Implementing Safety Features • Demonstrating IoT Capabilities*
1300 – 1315	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1315 – 1415	***COMPETENCY EXAM***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulators (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 Simutech Troubleshooting Electrical Circuits V4.1" and "Lab Volt Testing Device".





Simutech Troubleshooting Electrical Circuits V4.1

Lab Volt Testing Device

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