



COURSE OVERVIEW IE0566

Instrumentation and Control Engineering, Control Theory, Rotating Equipment Controls and Operation Certification

Course Title

Instrumentation and Control Engineering, Control Theory, Rotating Equipment Controls and Operation Certification

Course Date/Venue

May 11-15, 2025/Crowne Meeting Room, Crowne Plaza Al Khobar, KSA

Course Reference

IE0566

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 one of our state-of-the-art simulators.



This course is designed to provide participants with a detailed and up-to-date overview of instrumentation and control engineering, rotating equipment controls and operation. It covers pumps, blower, gas turbine and steam turbine; the reciprocating compressors and axial compressors; the elements of process control, signals, drawings and control loop operations; the PID and handling control loop interactions; the CCC-antisurge series 3+; the series 3 plus antisurge controller; and the prediction and tailored control response.



Further, the course will also discuss the surge or overload conditions, measurable variable and proportional-integral control for preventing reset windup; the performance and antisurge controllers tuning; the surge calculations; the destabilization prevention; the limit control and surge protection; the automatic start-up and shut-down logic; the transfer between manual and automatic operating modes; the operator error protection, modbus interface and operator interface module (OIM); and the preventive and predictive maintenance, speed and acceleration limiting and compressor and blowers discharge pressure limiting.

Course Objectives

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

- Apply and gain an in-depth knowledge on instrumentation and control engineering, control theory, rotating equipment controls and operation
- Operate rotating equipment that includes pumps, blower, gas turbine and steam turbine
- Discuss reciprocating compressors and axial compressors as well as the elements of process control, process control signals and drawings and process control loop operations
- Carryout PID and handling control loop interactions
- Illustrate CCC-antisurge series 3+ and discuss compressors and blowers and characteristic combination of maximum head and minimum flow
- Apply series 3 plus antisurge controller and determine how close the compressor is to surging
- Analyze surge prediction and tailored control response
- Explain surge or overload conditions, measurable variable and proportional-integral control for preventing reset windup
- Describe performance and antisurge controllers tuning, surge calculations automatically adapt to changing inlet conditions and open and closed-loop control responses
- Prevent destabilization and apply limit control and surge protection
- Employ automatic start-up and shut-down logic and illustrate transfer between manual and automatic operating modes
- Illustrate operator error protection, modbus interface and operator interface module (OIM)
- Employ preventive and predictive maintenance, speed and acceleration limiting and compressor and blowers discharge pressure limiting

Who Should Attend

This course provides an overview of all significant aspects and considerations of instrumentation and control engineering, rotating equipment controls and operation for instrument engineers, supervisors and technicians.

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**.*

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 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 * CEUs * Haward Technology * CEUs * Haward Technology * CEUs * Haward Technology *



Haward Technology Middle East

Continuing Professional Development (HTME-CPD)

CEUs

CEU Official Transcript of Records

TOR Issuance Date:

14-Nov-21

HTME No.

3558-6717-5364-9527

Participant Name:

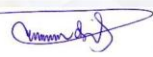
Abdulsatar Al Otaibi

Program Ref.	Program Title	Program Date	No. of Contact Hours	CEU's
IE0566	Instrumentation and Control Engineering, Control Theory, Rotating Equipment Controls and Operation Certification	10 Nov-14 Nov, 2021	32.5	3.25

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

3.25

TRUE COPY



Maricel De Guzman
Academic Director

Haward Technology has been approved as an Authorized 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 1-2013 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 1-2013 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









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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.

Accommodation

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



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. Barry Pretorius is a **Senior Electrical & Instrumentation Engineer** with almost **30** years of extensive experience within the **Oil, Gas, Petrochemical, Refinery & Power** industries. His expertise widely covers in the areas of **Distributed Control System (DCS), DCS Operations & Techniques, Plant Control** and **Protection Systems, Process Control & Instrumentation, Liquid & Gas Flowmetering, Custody Measurement, Ultrasonic Flowmetering, Loss Control, Loss Control & Multiphase Flowmetering, Custody Measurement & Loss Control, Gas Measurement, Cascade Control Loops, Split-Range Control Loops, Capacity Control & Other Advanced Control Schemes, Safety Instrumented Systems, Plant Automation Operations & Maintenance, Programmable Logic Controller (PLC), Siemens PLC Simatic S7-400/S7-300/S7-200, PLC & SCADA for Automation & Process Control, Artificial Intelligence, Allen Bradley PLC** Programing and **Hardware Trouble Shooting, Schneider SCADA System, Wonder Ware, Emerson, Honeywell, Honeywell Safety Manager PLC, Yokogawa, Advanced DCS Yokogawa, Endress & Hauser, Field Commissioning and Start up Testing Pre Operations, Fire & Gas Detection System, System Factory Acceptance Test (FAT), FactoryLink ECS, Modicon 484, Rockwell Automation, System Site Acceptance Test (SAT), SCADA HMI & PLC Control Logic, Cyber Security Practitioner, Cyber Security of Industrial Control System, IT Cyber Security Best Practices, Cybersecurity Fundamentals, Ethical Hacking & Penetration Testing, Cybersecurity Risk Management, Cybersecurity Threat Intelligence, OT Whitelisting for Better Industrial Control System Defense, NESA Standard and Compliance Workshop, OT, Cyber Attacks Awareness - Malware/Ransom Ware / Virus /Trojan/ Phishing, Information Security Manager, Security System Installation and Maintenance, Implementation, Systems Testing, Commissioning and Startup, Foxboro DCS & Triconics, SIS Systems, Advanced DC Drives, Motion Control, Hydraulics, Pneumatics and Control Systems Engineering, Electrical & Automation Control Systems, HV/MV Switchgear, LV & MV Switchgears & Circuit Breakers, High Voltage Electrical Safety, LV & HV Electrical System, HV Equipment Inspection & Maintenance, LV Distribution Switchgear & Equipment, Electrical Safety, Electrical Maintenance, Transformers, Medium & High Voltage Equipment, Circuit Breakers, Cable & Overhead Line Troubleshooting & Maintenance, Electrical Drawing & Schematics, Voltage Distribution, Power Distribution, Filters, Automation System, Electrical Variable Speed Drives, Power Systems, Power Generation, Diesel Generators, Power Stations, Uninterruptible Power Systems (UPS), Battery Chargers, AC & DC Transmission, CCTV Installation, Data & Fire Alarm System, Evacuation Systems and Electrical Motors & Variable Speed Drives, & Control of Electrical and Electronic devices.**

During Mr. Pretorius's career life, he has gained his practical experience through several significant positions and dedication as the **Technical Director, Automation System's Software Manager, Site Manager, Senior Lead Technical Analyst, Project Team Leader, Automation Team Leader, Automation System's Senior Project Engineer, Senior Project & Commissioning Engineer, Senior Instrumentation & Control Engineer, Electrical Engineer, Project Engineer, Pre-Operations Startup Engineer, PLC Specialist, Radio Technician, A.T.E Technician** and **Senior Instructor/Trainer** from various companies like the **ADNOC Sour Gas, Ras Al Khair Aluminum Smelter, Johnson Matthey Pty. Ltd, Craigcor Engineering, Unitronics South Africa Pty (Ltd), Bridgestone/Firestone South Africa Pty (Ltd)** and **South African Defense Force.**

Mr. Pretorius's has a **Bachelor of Technology in Electrical Engineering (Heavy Current).** Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM),** received numerous awards from various institutions and delivered numerous trainings, courses, workshops, seminars and conferences internationally.

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

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

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0900	Rotating Equipment Operation Pumps Types & Principles of Operation • Blower Principle of Operation • Gas Turbine Principle of Operation • Steam Turbine Principle of Operation
0900 – 0915	Break
0915 – 1000	Compressors & Blowers Compressors Principles of Operation • Reciprocating Compressors • Axial Compressors • Compressors Operating Map • Compressors Operating Point • Compressors Speed Curves • Compressors Performance Limits • Compressors Surge Phenomenon • Compressors Protection Methods
1000 – 1100	Introduction to Process Control Elements of Process Control • Process Control Signals • Process Control Drawings • Using Symbols and Diagrams in Process Control • Process Control Loop Operations
1100 – 1200	PID & Handling Control Loop Interactions
1200 – 1215	Break
1215 – 1420	CCC - Antisurge Series 3+
1420 – 1430	Recap
1430	Lunch & End of Day One

Day 2: Monday 14th of July 2025

0730 – 0900	<i>Compressors & Blowers Characteristic Combination of Maximum Head & Minimum Flow</i>
0900 – 0915	<i>Break</i>
0915 – 1030	<i>Series 3 Plus Antisurge Controller</i>
1030 – 1100	<i>Determination: How Close the Compressor is to Surging</i>
1100 – 1200	<i>Surge Prediction & Tailored Control Response</i>
1200 – 1215	<i>Break</i>
1215 – 1420	<i>Surge or Overload Conditions</i>
1420 – 1430	<i>Recap</i>
1430	<i>Lunch & End of Day Two</i>

Day 3: Tuesday 15th of July 2025

0730 – 0900	<i>Measurable Variable Compression Ratio • Pressure Drop Across a Flow Meter • Gas Composition • Suction Temperature & Pressure • Rotational Speed & Guide Vane Angle</i>
0900 – 0915	<i>Break</i>
0915 – 1030	<i>Energy-Wasting Margin of Safety</i>
1030 – 1100	<i>Proportional-Integral Control for Preventing Reset Windup</i>
1100 – 1200	<i>Performance & Antisurge Controllers Tuning</i>
1200 – 1215	<i>Break</i>
1215 – 1420	<i>Surge Calculations Automatically Adapt to Changing Inlet Conditions</i>
1420 – 1430	<i>Recap</i>
1430	<i>Lunch & End of Day Three</i>

Day 4: Wednesday 16th of July 2025

0730 – 0900	<i>Open & Closed-Loop Control Responses</i>
0900 – 0915	<i>Break</i>
0915 – 1030	<i>Destabilizing Prevention</i>
1030 – 1100	<i>Limiting Control & Surge Protection</i>
1100 – 1200	<i>Automatic Start-Up & Shut-Down Logic</i>
1200 – 1215	<i>Break</i>
1215 – 1420	<i>Transfer Between Manual & Automatic Operating Modes</i>
1420 – 1430	<i>Recap</i>
1430	<i>Lunch & End of Day Four</i>

Day 5: Thursday 17th of July 2025

0730 – 0800	<i>Operator Error Protection</i>
0800 – 0900	<i>Modbus Interface</i>
0900 – 0915	<i>Break</i>
0915 – 1030	<i>Operator Interface Module (OIM)</i>
1030 – 1100	<i>Preventive & Predictive Maintenance</i>
1100 – 1130	<i>Speed & Acceleration Limiting</i>
1200 – 1215	<i>Break</i>
1215 – 1300	<i>Compressor & Blowers Discharge Pressure Limiting</i>
1300 – 1315	<i>Course Conclusion</i>
1315 – 1415	<i>COMPETENCY EXAM</i>
1415 – 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch & End of Course</i>



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 one of our state-of-the-art simulators “Allen Bradley SLC 500”, “AB Micrologix 1000 (Digital or Analog)”, “AB SLC5/03”, “AB WS5610 PLC”, “Siemens S7-1200”, “Siemens S7-400”, “Siemens SIMATIC S7-300”, “Siemens S7-200”, “GE Fanuc Series 90-30 PLC”, “Siemens SIMATIC Step 7 Professional Software”, “HMI SCADA”, “Gas Ultrasonic Meter Sizing Tool”, “Liquid Turbine Meter and Control Valve Sizing Tool”, “Liquid Ultrasonic Meter Sizing Tool”, “Orifice Flow Calculator” and “Automation Simulator”.



Allen Bradley SLC 500 Simulator



Allen Bradley Micrologix 1000 Simulator (Digital)



Allen Bradley Micrologix 1000 Simulator (Analog)



Allen Bradley SLC 5/03



Allen Bradley WS5610 PLC Simulator PLC5



Siemens S7-1200 Simulator



Siemens S7-400 Simulator



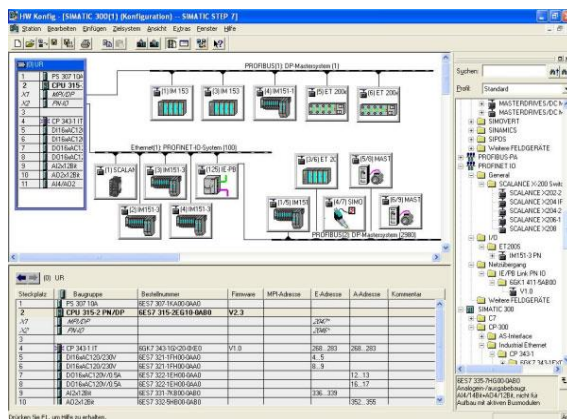
Siemens SIMATIC S7-300



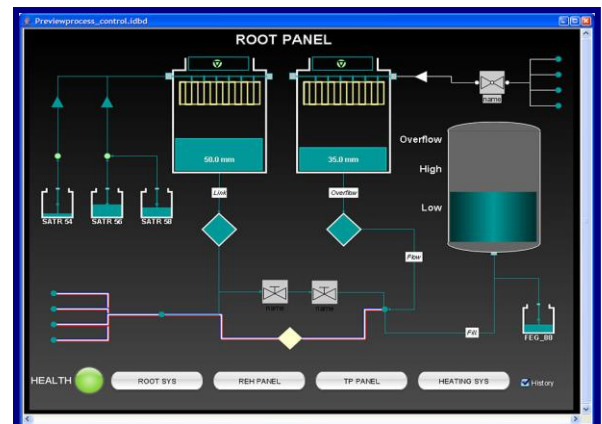
Siemens S7-200 Simulator



GE Fanuc Series 90-30 PLC Simulator



Siemens SIMATIC Step 7 Professional Software



HMI SCADA



	Flowrate SCFD	Pressure (psi)	Temperature (DegF)
Max Flow Condition	150,000,000	500	120
Operating Flow Condition	150,000,000	1100	120
Min Flow Condition	75,000,000	1100	50

Gas Ultrasonic Meter (USM) Sizing Tool Simulator

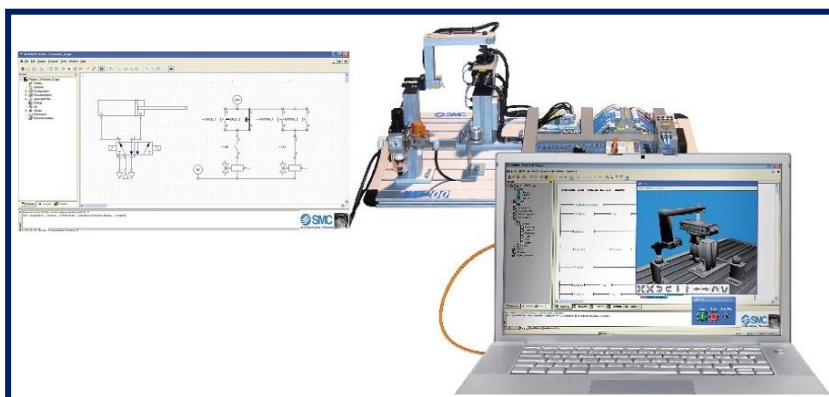
Liquid Turbine Meter and Control Valve Sizing Tool Simulator

	Flowrate SCFD	Pressure (psi)	Temperature (DegF)
Max Flow Condition	150,000,000	500	120
Operating Flow Condition	150,000,000	1100	120
Min Flow Condition	75,000,000	1100	50

Liquid Ultrasonic Meter Sizing Tool Simulator

Incomplete fluid data (Flowing Specific Gravity, Base Specific Gravity).

Orifice Flow Calculator Simulator



AutoSIM – 200 Automation Simulator

Course Coordinator

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