

Industrial Skills Courses

100 – Safety, Health, and Plant Science

101 – Personal Protective Equipment (PPE)

101-01	Personal Protective Equipment
101-02	Hearing and Noise Safety
101-03	Respiratory Protective Program
101-70	Introduction to OSHA
101-71	Introduction to Industrial Hygiene



102 – Worksite Safety

102-01	Slip, Trip, and Fall Prevention
102-02	Ladder Safety
102-03	Portable Power and Hand Tool Safety
102-04	Machine Hazards and Safety
102-05	Machine Guarding
102-06	Accident Causes, Prevention, and Investigation
102-07	Stationary Power Tool Safety
102-08	Laboratory Health and Safety
102-09	Operator Fatigue
102-10	Hazard Identification and Assessment

103 – First Aid

103-01	First Aid
103-02	Bloodborne Pathogens
103-03	First Aid Resuscitation: Choking, CPR, and AED
103-04	Temperature Related Stress and Illness

104 – Fire Prevention

104-01	Fire Prevention and Protection Program
104-02	Fire Extinguisher Safety
104-03	Combustible Dusts

105 – Lockout/Tagout

105-01	Lockout/Tagout Safety Program
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106 – Confined Space Safety

106-01	Confined Spaces: Entrant and Attendant Duties
106-02	Confined Spaces: Entry Supervisor Duties
106-80	Confined Spaces: Entrant and Attendant Duties (CAD)

107 – Electrical Safety

107-01	Electrical Safety
107-02	Energized Electrical Equipment Safety
107-03	Arc Flash Hazard Basics

108 – Materials Handling

108-01	Materials Handling and Storing Safety
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109 – Rigging Safety

109-01	Rigging Safety
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110 – Scaffolding Safety

110-01	Scaffolding Safety
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111 – Scissor Lift Safety

111-01	Scissor Lift Operations and Safety
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112 – Crane and Hoist Safety

112-01	Crane and Hoist Safety
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100

Safety, Health, and Plant Science

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Mechanical Maintenance

300

Electrical Transmission and Distribution

400

Electrical Maintenance

500

Power Generating Systems and Operations

600

Instrumentation and Control

700

Process Systems and Operations

800

Industrial Machining and Welding

NERC Online CEH Courses

Instructor-Led Training

Distribution

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113 – Forklift Safety

113-01 Forklifts and Powered Industrial Trucks Safety

114 – Fall Protection

114-01 Fall Protection

114-81 Fall Protection (CAD)

115 – Excavation and Trenching

115-01 Excavating and Trenching Safety

116 – Compressed Gas Cylinder Safety

116-01 Compressed Gas Cylinder Safety

117 – Hazardous Materials Safety

117-01 Hazardous Materials Safety

117-02 Acid and Caustic Awareness

117-03 Asbestos and Silica Awareness

117-04 Ammonia Awareness

117-05 Hydrogen Sulfide Awareness

117-06 Chlorine Awareness

117-07 Radiation Awareness

117-08 Hazardous Gases - Methane, Carbon Monoxide, and Carbon Dioxide

117-09 Lead Awareness

117-20 Gas Monitoring Basics

117-83 Asbestos Awareness (CAD)

117-85 Hydrogen Sulfide Awareness (CAD)

118 – HAZWOPER

118-01 HAZWOPER Regulation Overview

118-02 Site Characterization and Analysis

118-03 Toxicology

118-04 Medical Surveillance

118-05 Decontamination

118-06 Emergency Procedures



119 – Hazard Communications

119-03 Hazardous Communications Employee Training Program, Part 1

119-04 Hazardous Communications Employee Training Program, Part 2

119-06 Hazard Communication Programs in the Workplace

119-07 Exposure to and Detection of Hazardous Chemicals

119-08 Physical, Health, and Environmental Hazard Classes

119-09 Labeling and SDS for Hazardous Chemicals

122 – Transportation

122-01 Driving Safety Practices

122-02 Drug and Alcohol Awareness

130 – Behavior Based Safety Training

130-01 Behavior Based Safety Programs Basic Design

130-02 Behavior Based Safety Program Concepts

130-03 Hazardous Material Procedures

130-04 Confined Space Procedures

130-05 Hot Work Procedures

130-06 Root Cause Analysis

130-07 Safety and Health Programs

131 – Ergonomics

131-01 Ergonomics in an Office Environment

131-02 Ergonomics in an Industrial Environment

131-03 Proper Lifting Technique



140 – Qualified Electric Worker

140-01 General Concepts and Job Briefings

140-04 Enclosed Spaces

140-09 Electrical Clearances

140-11 Mechanical Equipment

140-18 Dog Bite Prevention

150 – Environmental Awareness

150-01 Environmental Awareness

150-02 Storm water Regulations and Pollution Prevention Plans

150-03 Spill Prevention, Control, and Countermeasures

160 – Construction Safety

160-01 Health Hazards in Construction

160-02 Scaffolding Safety for Construction

160-03 Portable Power and Hand Tool Safety for Construction

160-04 Materials Handling and Storing Safety For Construction

160-05 Personal Protective Equipment for Construction Part 1

160-06 Personal Protective Equipment for Construction Part 2

160-07 Excavation and Trenching Safety for Construction

160-08 Fall Protection for Construction

160-09 Ladder Safety for Construction

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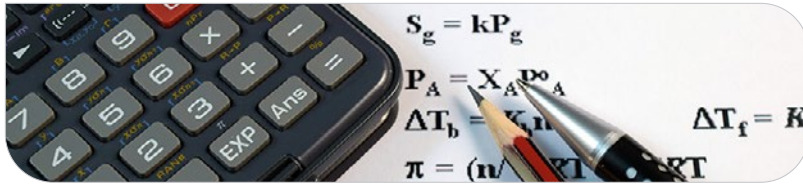
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170 – Industrial Mathematics

- 170-01 Introduction to Industrial Math
- 170-02 Industrial Math: Measurements and Calculation
- 170-03 Industrial Math: Fractions, Percentages, and Ratios



200 – Mechanical Maintenance

201 – Intro to Industrial Maintenance and the Tools of the Trade

- 201-01 Working Principles of Simple Machines
- 201-02 Hand Tools, Part 1
- 201-03 Hand Tools, Part 2
- 201-04 Portable Power Tools
- 201-05 Torque Wrenches

202 – Belt Drive Maintenance

- 202-01 Introduction to Belt Drive Maintenance
- 202-02 V-belts
- 202-03 Positive Traction Belt Drives
- 202-04 Sheave Maintenance
- 202-05 Introduction to Conveyor Systems
- 202-06 Conveyor System Designs
- 202-07 Conveyor Belt System Inspection and Operation
- 202-08 Conveyor Belt Installation and Repair



203 – Bearing Maintenance

- 203-01 Introduction to Bearings
- 203-02 Rolling Contact Bearings
- 203-03 Sliding Surface Bearings

171 – Industrial Sciences

- 171-01 Atomic Structure and Chemical Bonding
- 171-02 Introduction to the Periodic Table of Elements
- 171-03 Chemical Formulas, Reactions, and Solubility
- 171-04 Introduction to Hydrocarbon Chemistry
- 171-05 Chemical Equations
- 171-10 Introduction to Physics: Force and Motion
- 171-11 Introduction to Physics: Energy, Work, and Power

180 – Human Performance

- 180-01 Fundamentals of Human Performance Improvement

- 203-04 Bearing Installation and Removal
- 203-05 Bearing Seals
- 203-06 Troubleshooting Bearing Failures

205 – Gear Maintenance

- 205-01 Introduction to Gear Drives
- 205-02 Types of Gears
- 205-03 Maintaining Gear Drives
- 205-04 Clutches



207 – Lubrication of Rotating Machinery

- 207-01 Lubrication Selection and Sampling in Rotating Machinery
- 207-02 Lubrication Failures and Management in Rotating Machinery
- 207-03 Lubrication Analysis in Rotating Machinery

208 – Piping and Tubing

- 208-01 Pipe Connections and Symbols
- 208-03 Piping Construction and Sizing
- 208-04 Piping Expansion, Support, and Insulation
- 208-05 Piping Auxiliaries
- 208-06 Tubing Types and Applications
- 208-07 Tube Fittings and Connection Methods
- 208-08 Tube and Conduit Bending

209 – Shaft Alignment

- 209-01 Couplings
- 209-03 Pre-Alignment Procedures
- 209-04 Rough Alignment
- 209-05 Mathematical Rim-and-Face Alignment
- 209-06 Graphical Rim-and-Face Alignment
- 209-07 Reverse Dial Alignment
- 209-09 Laser Alignment

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211 – Chain Drive Maintenance

211-01	Introduction to Chain Drives
211-02	Chain Drive Maintenance and Troubleshooting

213 – Lubrication

213-01	Lubrication Basics
213-02	Types of Lubricants
213-03	Lubrication Sampling and Analysis
213-04	Lubrication Filtration and Purification
213-05	Lubrication Delivery Methods and Systems

215 – Valve Selection and Maintenance

215-01	Introduction to Valves and Their Components
215-02	Valve Actuators
215-03	Gate Valves
215-04	Globe Valves
215-05	Butterfly Valves
215-06	Ball Valves
215-07	Check Valves
215-08	Needle Valves
215-09	Plug Valves
215-10	Diaphragm Valves
215-11	Pinch Valves
215-12	Safety and Relief Valves
215-13	Solenoid Valves
215-14	Valve Positioners
215-15	Pressure Regulator Valves



219 – Centrifugal Pumps

219-01	Introduction to Centrifugal Pumps
219-02	Centrifugal Pump Design
219-03	Centrifugal Pump Fundamentals
219-04	Centrifugal Pump Operation and Maintenance, Part 1
219-05	Centrifugal Pump Operations and Maintenance, Part 2
219-08	Impellers and Wear Rings
219-10	Pump Troubleshooting
219-12	Pump Internal Inspection and Troubleshooting

223 – Heat Exchangers

223-01	Heat Exchanger Theory
223-02	Open Heat Exchanger Design and Operation
223-03	Closed Heat Exchangers

225 – Compressors

225-01	Plant Compressed Air Systems
225-02	Compressed Air System Components
225-03	Positive Displacement Compressors

225-04	Dynamic Compressors
225-06	Axial Compressor Control Schemes

229 – Fasteners and Seals

229-01	Bolted Joints
229-02	O-Rings
229-03	Making Gaskets
229-04	Fasteners
229-05	Packing Material Use and Installation
229-06	Mechanical Seals Use and Installation



231 – Positive Displacement Pumps

231-01	Introduction to Positive Displacement Pumps
231-02	Reciprocating Positive Displacement Pumps
231-03	Rotary Positive Displacement Pumps

243 – Hydraulics

243-01	Introduction to Hydraulics
243-02	Hydraulic Systems
243-03	Hydraulic Fluids

271 – Vibration

271-01	Vibration Introduction
271-02	Vibration Causes and Characteristics
271-04	Plant Vibration Program

273 – Boiler Repair

273-01	Boiler Tube Repair
273-02	Inspecting the Fireside of a Boiler, Part 1
273-03	Inspecting the Fireside of a Boiler, Part 2
273-04	Inspecting the Waterside of a Boiler
273-05	Inspecting a Boiler's Exterior
273-06	Waterside and Fireside Cleaning of Boiler



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300 – Electrical Transmission and Distribution

301 – Distribution Systems

301-02	Electrical Distribution System Fundamentals*
301-03	Primary and Secondary Distribution Systems
301-04	Distribution System Components and Application
301-05	Characteristics of Distribution Switchgear
301-06	Load Characteristics and Management*
301-07	Principles of Revenue Metering
301-08	Single and Poly-Phase Metering*



312 – Basic Electricity Fundamentals

312-01	Basic Electricity*
312-02	Laws of Electricity*
312-03	AC, DC, and Circuit Interactions*
312-04	Three Phase AC Connections & Effects*
312-05	Electric Devices*
312-06	Ohm's Law, Energy Formulas, Basic Concepts of Circuits*
312-07	Formulas for Voltage and Current Division*
312-08	Inductance, Capacitance, Phase, and Power Angles*
312-09	Phasors, Capacitance, Inductance, and Symmetrical Components*
312-10	Electromagnetism, Induction, Transformers, and Conductors*
312-11	Generators, Torque Angle, and Synchronizing*



320 – Power Markets

320-01	Market Concepts*
320-02	Regulators, RTOs, ISOs, Long Term Power Supply*
320-03	Near Term, Day Ahead, Hour Ahead, Real Time Power Supply*
320-04	Ancillary Services*
320-05	Risk Protection*

345 – Introduction to NERC

345-01	NERC Overview and Application for Generator Operators*
345-03	PER-006 for Generator Operators
345-10	FERC Standards of Conduct*

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350 – System Protection

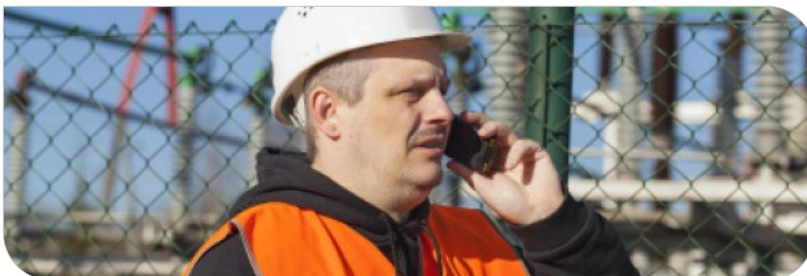
350-01	Elements of System Protection*
350-02	Types of Protective Relays*
350-03	Monitoring System Conditions*
350-04	Disturbance Monitoring Equipment*
350-05	Line Protection*
350-06	Transformer Protection*
350-07	Pilot Protection*
350-09	Bus Protection*
350-10	Generator Protection*
350-11	Protection System Misoperation*
350-12	Protection Systems Maintenance Programs*
350-14	General Relay Operations and Categories and Input*
350-15	Auxiliary Relays*
350-16	Fault Analysis, Relay Coordination, and Back-up Protection*
350-17	Breaker Operations*
350-18	Protection & Control*
350-19	Protection and Switching*
350-20	Remedial Action Schemes*

375 – Resource and Demand Balancing

375-12	Real Power Balancing Control Performance (BAL-001)*
375-13	Disturbance Control Performance (BAL-002)*
375-14	Inadvertent Interchange (BAL-003/BAL-005)*
375-15	Area Control Error Equation*
375-16	Evaluation and Implementation of Interchange Transaction (INT-006/INT-009)*
375-17	Generation*
375-18	Real Power Balancing Concepts

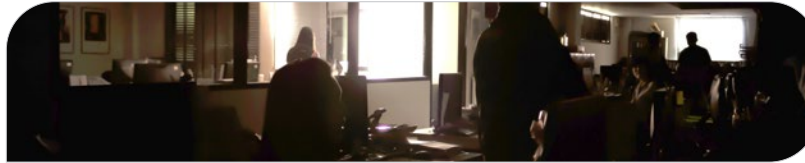
376 – Communication

376-04	Communication (COM-001/COM-002)*
376-05	Principles of Synchrophasors
376-06	Application of Synchrophasors
376-07	Effective Communication Overview*
376-08	Effective Verbal Communication*
376-09	Effective Written Communication*
376-10	Effective Communication Strategies and Best Practices*



377 – Critical Infrastructure Protection

377-06	Critical Infrastructure Protection Overview*
377-07	CIP Physical and Electronic Access (CIP-004/CIP-006)*
377-08	CIP Incident Response, Recovery, Data Protection, and Risk Management*



378 – Emergency Operations Planning

378-09	Event Reporting and Emergency Operations (EOP-004/EOP-011)*
378-10	System Restoration from Blackstart and System Restoration Coordination (EOP-005/EOP-006)*
378-11	Loss of Control Center and Geomagnetic Disturbance Operations (EOP-008/EOP-010)*
378-12	Energy and Weather Event Summary*
378-13	Energizing and Restoring the Electric System*
378-14	Identifying and Responding to Blackouts*
378-15	Performing System Restoration*
378-18	Blackout Events*
378-19	Geomagnetic Disturbances*

381 – Interconnection Reliability Operations and Coordination

381-07	IRO-001, IRO-006, IRO-008, and IRO-009 Reliability Coordinator Responsibilities*
381-08	IRO-002, IRO-010, IRO-014, IRO-017, and IRO-018 Reliability Coordinator Data Needs*

387 – System Operations

387-03	Economic Power System Operations
387-05	Interconnected Energy Accounting*
387-07	Supervisory Control and Data Acquisition Systems (SCADA)*
387-11	Basics of Power System Operations*
387-12	Human Performance for System Operators*
387-13	Renewable Energy Integration*
387-14	Solar, Hydro, Tidal, Geothermal, and Variable Generation*
387-15	Wind Generation*
387-16	Operations Planning, Monitoring, Analysis (TOP-002/TOP-003/TOP-010)*
387-17	Transmission Operations (TOP-001)*
387-18	Power System Concepts*
387-19	Transmission and Distribution Operations*
387-20	Emergency Response Application with Simulation*
387-21	Transmission Stations and Switchyards*
387-22	Transformer Principles*
387-23	Circuit Breakers and Disconnects*

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Industrial Machining and Welding

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387 – System Operations, *continued...*

387-24	Transmission Lines, Station Protection, and Monitoring and Control*
387-25	Distribution and Shift Factors*
387-27	Contingency Analysis Application with Simulation*
387-29	Advanced Human Performance for System Operators*
387-30	Overview, Interconnected Power Systems Operations*
387-31	Transmission, Substations, and System Protection*
387-32	Control Center Operations and Governance*
387-33	Basic Electricity Concepts for System Operators*
387-34	Transmission Application with Simulation*
387-35	Math for System Operators*
387-37	Human Performance for System Operators - Error Prevention*

388 - Active and Reactive Power

388-08	Reactive Power Fundamentals*
388-09	Reactive Power Production Equipment*
388-10	Power Control Scenarios*

400 – Electrical Maintenance

401 – Direct Current (DC)

401-01	Electron Theory
401-02	Magnetism and Electromagnetism Explained
401-03	Ohm's and Kirchoff's Laws Relating to DC Circuits
401-04	Evaluating Series and Parallel DC Circuit Performance
401-05	Determine Circuit Outputs from Specified Inputs



402 – Alternating Current (AC)

402-01	Introduction to Alternating Current (AC)
402-02	Ohm's and Kirchoff's Laws Involving AC Circuits
402-03	Inductance in AC Circuits
402-04	Capacitance in AC Circuits
402-05	Impedance in AC Circuits
402-06	AC Power
402-07	Fundamentals of Three-Phase AC

388-11	Electric Power Principles*
388-12	Voltage and Reactive Control*
388-13	Generators and Transmission Lines*
388-14	Generation Operations for Maintaining Network Voltage Schedules*
388-15	Voltage and Power Control Equipment

395 - NERC Compliance Training

395-10	Compliance Awareness - Blackout Events
395-11	Compliance Awareness - NERC Functional Entities
395-12	Compliance Awareness - Internal Control Evaluation
395-13	Compliance Awareness - NERC Program Development
395-14	Compliance Awareness - Awareness of Standards and Their Impact



405 – Power Quality

405-01	Power Quality
405-02	Harmonics
405-03	High Voltage AC

409 – Industrial Motors

409-01	AC Induction Motors
409-02	AC Generators
409-03	AC Induction Motor Theory
409-04	Troubleshooting AC Induction Motors
409-05	AC Induction Motor Maintenance
409-06	Overhauling Induction Motors
409-07	Generator System Heat Protection
409-08	Generator Overhaul
409-09	DC Motors and Generators
409-10	Maintenance of Direct Current Motors and Generators

411 – Motor Control and Protection

411-01	Introduction to Motor Controls
411-02	Motor Protection and Faults
411-03	Motor Control Troubleshooting
411-04	Motor Control Centers

413 – AC Drives

413-01	AC Drives Overview
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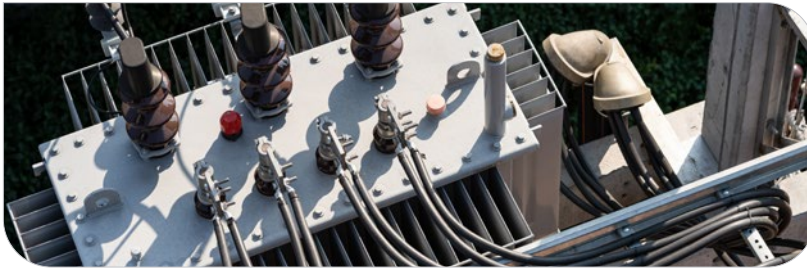
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415 – Transformers

415-01	Transformer Basics
415-02	Transformer Design and Components
415-03	Transformer Connections
415-04	Special Transformers



416 – Batteries, Battery Chargers, and UPS

416-01	Battery Basics
416-02	Electrical Backup Systems
416-03	Uninterruptible Power Supplies (UPS)

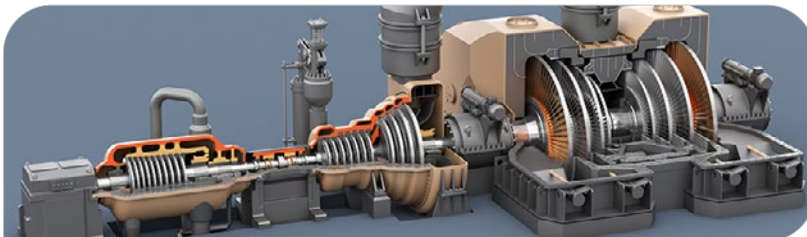
417 – Switchgear Maintenance

417-01	Switchgear
417-02	Low Voltage Breakers
417-03	Medium and High Voltage Switchgear
417-04	General Switchgear Maintenance
417-05	Breaker Specific Maintenance
417-06	Circuit Breaker Time-Travel Characteristics and Testing

500 – Power Generating Systems and Operations

501 – Power Generation

501-01	Energy Conversions
501-02	Steam Turbine Basics
501-03	Combustion System Component Overview
501-04	Boiler Water and Steam Cycle Overview
501-05	Generator Overview



418 – Electrical Protection and Grounding

418-01	Electrical Faults and Current Ratings
418-02	Overcurrent Protection, Fuses, and Breakers
418-03	Protection Relays
418-04	Generator, Transformer, and Motor Protection
418-05	Grounding and Bonding

419 – Motor Operated Valves

419-01	MOV (Motor Operated Valve) Application and Construction
419-02	MOV Disassembly and Inspection, Part 1
419-03	MOV Disassembly and Inspection, Part 2
419-04	Limit Switch Adjustment

421 – Wiring Installation

421-01	Wire and Cable Management
421-02	Terminating and Connecting Wires in a Control Panel
421-03	Making Connections in a Junction Box
421-04	Installing Conduit and Pulling Wire

423 – Cable Splicing

423-01	Introduction to Medium Voltage Cable
423-02	Medium Voltage Splices and Terminations

425 – Troubleshooting Electrical Circuits

425-01	Troubleshooting AC Circuits
425-02	Troubleshooting DC Circuits

427 – Freeze Protection

427-01	Electrical Freeze Protection Components and Application
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505 – Turbine Auxiliaries System and Control

505-01	Steam Turbine Design
505-02	Steam Turbine Control and Operation*
505-03	Steam Turbine Auxiliaries
505-10	Steam Turbine Governor System

507 – Generator and Auxiliary Systems and Control

507-01	Generator and Auxiliary Systems' Functions*
507-02	Generator and Auxiliary Systems' Flow Paths and Major Components
507-03	Generator Construction and Process Control*
507-04	Generator and Auxiliary Systems Start-up
507-05	Generator and Auxiliary Systems Normal Operations
507-06	Generator and Auxiliary Systems Shutdown

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511 – Combustion Turbine Fundamentals

511-01	Gas Turbine Fundamentals and Configuration of Generating Facilities
511-02	Introduction to the GE LM Series Gas Turbine
511-03	Introduction to GE Frame Series Gas Turbines
511-04	Introduction to the Siemens V-Series Gas Turbine
511-05	Heavy Duty Gas Turbines – Major Components and Support Systems
511-07	Aero-derivative Gas Turbines – Major Components and Support Systems
511-10	Fundamentals of Gas Turbine Operation and Routine Maintenance
511-11	Gas Turbine Control Schemes
511-12	Gas Turbine Fuel and Combustion Systems
511-13	Gas Turbine Lube Oil and Control Oil Systems
511-14	Gas Turbine Air Systems
511-15	Gas Turbine Water Wash and Drain Systems

521 – Combustion Air and Flue Gas System

521-01	Introduction to Combustion Air and Flue Gas Systems
521-02	Combustion Air and Flue Gas Flow Paths and Components
521-03	Control Loops and Methods of Control
521-04	Combustion Air and Flue Gas System Start-up
521-05	Maintaining Fan Operations in Combustion Air and Flue Gas Systems
521-06	Combustion Air and Flue Gas System Shutdown Process

522 – Coal Handling System

522-01	Coal Handling System
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523 – Boiler Fuel Systems

523-01	Boiler Fuel System Function
523-02	Process and Methods of Control for the Boiler Fuel System
523-03	Boiler Fuel System Start-up
523-04	Normal Operation of the Boiler Fuel Systems
523-05	Shutdown of the Boiler Fuel System

531 – Hydrocarbon Fired Boilers

531-01	Combustion Theory
531-02	Basic Boiler Design
531-03	Boiler Valves and Steam Fittings
531-04	Boiler Fuel and Air Systems
531-05	Boiler Water and Steam Cycle
531-06	Boiler Heat Recovery Systems
531-07	Scrubbers and Ash Removal Systems
531-08	Boiler Operator Roles and Responsibilities

533 – Boiler Firing Controls and Components

533-01	Fuel Combustion and Controls
533-02	Boiler Burner Controls and Management



535 – Fundamental Aspects of Emission Controls

535-01	Flue Gas Desulfurization System
535-02	Flue Gas Desulfurization System, Open Spray Design, Part 1
535-03	Flue Gas Desulfurization System, Open Spray Design, Part 2
535-04	Dry Scrubber Operation
535-05	Selective Catalytic Reduction (SCR) System
535-09	Introduction to Continuous Emission Monitoring Systems
535-10	Fundamentals of Using a CEMS
535-11	Calibration of CEMS Components

551 – Circulating Water System

551-01	Introduction to the Circulating Water System
551-02	Function of the Circulating Water System
551-03	Circulating Water System Components
551-04	Circulating Water System Start-up
551-05	Circulating Water System Normal Operations
551-06	Circulating Water System Shutdown
551-07	Circulating Water System Controls
551-08	Cooling Towers: Operating Principles and Designs
551-09	Cooling Towers: Components
551-10	Air Cooled Condensers



553 – Condensate and Feedwater Systems

553-01	Introduction to the Condensate System
553-02	Introduction to the Feedwater System
553-03	Condensate and Feedwater Systems Operation
553-04	Condensate and Feedwater System Control

555 – Boiler Feed Pumps

555-01	Boiler Feed Pump and Associated Auxiliary Equipment
555-02	Boiler Feed Pump Flow Path and Major Components
555-03	Boiler Feed Pump Water Supply and Control Systems
555-04	Boiler Feed Pump Startup
555-05	Boiler Feed Pump Daily Operations

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557 – Boiler Water and Steam Systems

557-01	Function of Boiler Water and Steam Systems
557-02	Flow Paths and Components of the Boiler Water and Steam Systems
557-03	Process Controls for Boiler Water and Steam Systems
557-04	Startup Procedures for the Boiler Water and Steam Systems
557-05	Normal Operation of the Boiler Water and Steam Systems
557-06	Shutdown of the Boiler Water and Steam Systems

559 – Water Treatment

559-01	Molecular Chemistry of Water
559-02	Elements and the Periodic Table of Elements
559-03	Chemical Compounds
559-04	Corrosion Causes and Effects
559-05	Corrosion Control in Steam Production
559-06	Steam Chemistry Control Guidelines
559-07	Industrial Water Treatment Systems
559-08	Introduction to Desalination
559-09	Desalination: Pre- and Post-treatment of Water
559-10	Reverse Osmosis
559-11	Thermal Desalination Technologies

560 – Plant Electrical Systems

560-01	Main Transformers
560-02	Station Service System
560-03	Fuses and Circuit Breakers
560-04	Protective Relays and Instrument Transformers
560-05	Equipment Disconnects and Grounding



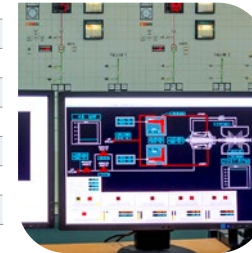
561 – Unit Start-up and Shutdown

561-01	Preparing for Power Plant Startups
561-02	Power Plant Startup Procedures
561-03	Preparing for Power Plant Shutdown
561-04	Power Plant Shutdown Procedures

563 – Efficiency, Reliability, and Environmentally Sensitive Operations

563-01	Basic Power Plant Efficiency
563-02	Water and Steam: Terms and Principles
563-03	Heat Transfer Principles
563-04	Laws and Principles of Thermodynamics
563-05	Performance Parameters

563-06	Balancing Efficiency, Availability, Capability and Flexibility
563-07	Instrumentation and Controls
563-08	Boiler Efficiency
563-09	Boiler Reliability
563-10	Turbine Efficiency
563-11	Condenser Efficiency
563-12	Condenser Operation and Reliability
563-13	Feedwater Heater Operation and Efficiency
563-14	Pump Efficiency and Reliability
563-15	Environmentally Sensitive Operations



565 – Plant Control System

565-01	Distributed Control System Fundamentals
565-02	Distributed Control System Components
565-03	Using Distributed Control System Diagrams
565-04	Power Plant Unit Control

567 – Heat Rate Optimization

567-01	Basic Principles of Water and Steam
567-02	Saturated Steam Tables
567-03	Superheated Steam Tables

581 – Diesel Power Plant Operations

581-01	Diesel Engines for Power Generation
581-02	Diesel Engine Support Systems
581-03	Diesel Powered Generation
581-04	Diesel Power Plant Operations
581-05	Diesel Plant Control Systems and Protective Devices
581-06	Diesel Plant Routine Maintenance

582 – Combined Cycle Power Plant Operations

582-01	Combined Cycle Power Plants
582-02	Combined Cycle Power Plant Components
582-03	HRSG – Flow Path and Major Equipment
582-04	HRSG – Auxiliary Equipment and Systems
582-05	HRSG – Basic Operating Concerns and Conditions
582-06	Combined Cycle Steam and Feedwater Operating Principles
582-07	Combined Cycle Condensate and Circulating Water Systems
582-08	Combined Cycle Auxiliary Systems
582-10	Steam Turbines in a Combined Cycle Plant
582-12	Combined Cycle Instrument and Control Air System
582-13	Control Loops in a Combined Cycle Plant
582-14	Combined Cycle Services and Fire Water Systems



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583 – Hydroelectric Power Plant Operations

583-01	The Hydroelectric Role in the Power System
583-02	Hydroelectric Power Stations
583-03	Water Management
583-04	Hydroelectric Generators
583-05	Generator Monitoring and Control
583-06	Hydroelectric Plant Auxiliaries
583-07	Operating Electrical Equipment in a Hydroelectric Plant
583-08	Mechanical Governor
583-09	Electric Governor

584 – Biomass Energy

584-01	Introduction to Biomass Power Plants
584-02	Biomass and Waste to Energy Power Plants

585 – Wind Energy

585-01	Basic Wind Turbine Design
585-02	Wind Farm Development
585-03	Horizontal Wind Turbine Design and Operation
585-04	Wind Energy Production

586 – Reciprocating Engine Power Plants

586-01	Introduction to Reciprocating Engine Power Plants
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586-03	Fundamentals of Reciprocating Engine Design
586-05	Reciprocating Engine Auxiliary Systems
586-06	Reciprocating Engine Electrical and Control Systems
586-07	Reciprocating Engine Operations
586-09	Generator Control in Reciprocating Engine Power Plants
586-11	Reciprocating Engine General Inspection

587 – Nuclear Energy

587-01	Nuclear Power Principles and Designs
587-02	PWR and BWR Operation and Design

588 – Battery Energy Storage Systems (BESS)

588-01	Introduction to Battery Energy Storage Systems (BESS)
588-02	Battery Energy Storage System Design
588-03	Battery Performance and Degradation
588-04	BESS Grid Integration and Hybrid Energy Systems
588-05	Battery Monitoring and Control
588-06	BESS Data Management and Reporting

589 – Solar Energy

589-01	Introduction to Solar Energy
589-03	Solar Energy – Photovoltaic
589-05	Solar Energy – Thermal Applications

600 – Instrumentation and Control

603 – Process Control Variables

603-01	Instrumentation and Control Overview
603-02	Principles of Temperature
603-03	Principles of Pressure
603-04	Principles of Level
603-05	Principles of Flow
603-06	Temperature Instruments
603-07	Pressure Measuring Devices
603-08	Level Measuring Devices
603-09	Flow Measuring Devices
603-15	Weight Measuring Devices

605 – Test Equipment

605-01	Multimeter
605-02	Oscilloscopes
605-03	Power Supplies
605-04	Signal Generators
605-05	Temperature Calibrators
605-06	Manometers
605-07	Pressure and Vacuum Calibrators
605-08	Megohmmeter
605-09	Loop Calibrators

607 – Analyzers

607-01	Analytical Instruments
607-02	Introduction to Analytical Testing

609 – Calibration and Troubleshooting

609-01	Calibration Overview, Part 1
609-02	Calibration Overview, Part 2
609-03	Introduction to Troubleshooting
609-04	Instrument Troubleshooting

611 – Prints and Drawings

611-01	P&ID Basics
611-02	Reading a P&ID
611-03	Electrical Drawings
611-04	Logic Diagrams
611-05	Industrial Print Reading Overview
611-21	Introduction to Engineering Drawings

613 – Automated Control

613-01	Introduction to Automated Control
613-02	Pneumatic Control Systems
613-03	Introduction to Switches

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613-04 Electronic Control Systems

615 – Signal Transmission and Conversion

- 615-01 Signal Transmission
- 615-02 Basic Principles of Industrial Transmitters
- 615-03 Smart Transmitters
- 615-04 Transducers

617 – Controllers and Final Control

- 617-01 Controller Control Modes
- 617-02 Operation of Automatic-Manual Transfer Stations
- 617-03 Final Control Elements



700 – Process Systems and Operations

701 – Petroleum Refining

- 701-01 Introduction to Petroleum Refining
- 701-02 Basic Petroleum Chemistry
- 701-03 OSHA's Process Safety Management Standard
- 701-04 History of Refining
- 701-05 Introduction to Crude Oil
- 701-06 Operator Qualifications in Refining
- 701-07 Maintenance Requirements in Petroleum Refining
- 701-08 Predictive and Reactive Maintenance



619 – Electronics Fundamentals

- 619-01 Introduction to Industrial Electronics
- 619-07 Digital Electronics and Microprocessors

621 – Programmable Logic Controllers

- 621-01 Introduction to Programmable Logic Controllers (PLC)
- 621-02 Input/Output (I/O) Processing
- 621-03 Inputs and Outputs
- 621-04 PLC (Programmable Logic Controllers) Programming Instructions, Part 1
- 621-05 PLC (Programmable Logic Controllers) Programming Instructions, Part 2
- 621-06 PLC (Programmable Logic Controllers) Networks
- 621-07 PLC Network Protocols

670 – Heating & Cooling Fundamentals

- 670-01 Air Conditioning Fundamentals
- 670-02 Ductless Air Conditioning
- 670-03 Introduction to Industrial and Commercial Refrigeration
- 670-05 Refrigerant System Troubleshooting
- 670-06 Chiller Design and Maintenance
- 670-09 Ducting and Air Movement for HVAC Systems
- 670-15 District Energy Basics
- 670-17 Package Boiler Fundamentals
- 670-19 Package Boiler Design
- 670-21 Package Boiler Startup, Operation, Shutdown and Maintenance
- 670-23 Package Chiller Fundamentals
- 670-25 Package Chiller Design
- 670-27 Package Chiller Startup, Operation, Shutdown and Maintenance

705 – Refining Operations

- 705-01 Refinery Overview and Configuration
- 705-03 Crude Unit
- 705-05 Catalytic Reformer
- 705-07 Fluid Catalytic Cracking
- 705-09 Coker Operations
- 705-11 Gasoline Blending
- 705-12 Diesel and Other Fuels
- 705-13 Sweetening
- 705-15 Sulfuric Acid Plant
- 705-17 Finishing Processes and Hydrotreating
- 705-19 Support Plants and Regulations
- 705-21 Natural Gas Refining
- 705-23 Lubricants
- 705-25 Asphalt



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* NERC CEHs are available for qualified operators. Courses taken to fulfill NERC CEH requirements must be indicated at time of purchase.

707 – Process Heaters

707-01 Features and Operation of Process Heaters

709 – Process Tanks

709-01 Features and Uses of Process Tanks

711 – Distillation

711-01 Introduction to Distillation

711-02 Operation of a Distillation Column

713 – Process Separators

713-01 Introduction to Process Separators

715 – Process Reactors

715-01 Introduction to Process Reactors

717 – Reforming and Synthesis

717-01 Introduction to Naphtha Reforming

719 – Process Safety Systems

719-01 Safety Alarm Systems and Instrumentation

719-02 Overpressure Safety Systems

721 – Process Utilities Systems

721-01 Process Utilities Systems, Part 1

721-02 Process Utilities Systems, Part 2

723 – Process Product Movement and Storage

723-01 Process Product Movement and Shipment

723-02 Tanks and Vessels Used for Storage

725 – Process Sampling and Testing

725-01 Sampling Principles and Methods

725-02 Testing Principles and Procedures

800 – Industrial Machining and Welding

801 – Precision Measurement

801-01 Intro to Measuring and Care of Measuring Tools

801-02 Measuring Rules and Tapes

801-03 Micrometers

801-04 Fixed Gauges

801-05 Measuring with Calipers

801-06 Dial Indicators

801-07 Telescoping Gauges

803 – Layout and Bench Work

803-01 Layout and Bench Work

803-02 Threading and Tapping

805 – Vertical Milling Machine

805-01 Vertical Milling Machine

807 – Engine Lathe

807-01 Engine Lathe

809 – Surface Grinder

809-01 Surface Grinder

811 – Pedestal Grinder

811-01 Pedestal Grinder



813 – Band Saw

813-01 Band Saw

815 – Drill Press

815-01 Drill Press

820 – Rigging, Lifting, and Elevated Work Surfaces

820-01 Scaffold Erection and Components

820-02 Rigging, Part 1

820-03 Rigging, Part 2

820-04 Rigging, Part 3

820-05 Ladders

820-06 Overhead Cranes

820-07 Aerial Lift Devices

841 – Welding and Cutting for Maintenance

841-01 Safe Welding and Cutting Practices

841-02 Weldability of Metals

841-03 Shielded Metal Arc Welding (SMAW)

841-04 Gas Metal Arc Welding (GMAW)

841-05 Tungsten Inert Gas (TIG) Welding

841-06 Oxyacetylene Welding (OAW)

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NERC Online Courses

		CEH	STD	SIM	EO
301-02	Electrical Distribution System Fundamentals	2.0	--	1.0	--
301-06	Load Characteristics and Management	1.5	1.0	--	--
301-08	Single and Poly-Phase Metering	1.0	--	--	--
312-01	Basic Electricity	1.0	--	--	--
312-02	Laws of Electricity	1.0	--	--	--
312-03	AC, DC, and Circuit Interactions	1.0	--	--	--
312-04	Three-Phase AC Connections and Effects	1.5	--	--	--
312-05	Electric Devices	1.0	--	--	--
312-06	Ohm's Law, Energy Formulas, Basic Concepts, Circuits	1.0	--	--	--
312-07	Formulas for Voltage and Current Division	1.0	--	--	--
312-08	Inductance, Capacitance, and Phase and Power Angles	1.0	--	--	--
312-09	Phasors, Capacitance, Inductance, and Symmetrical Components	1.0	--	--	--
312-10	Electromagnetism, Induction, Transformers, and Conductors	1.0	--	--	--
312-11	Generators, Torque Angle, and Synchronizing	1.0	--	--	--
320-01	Market Concepts	1.0	--	--	--
320-02	Regulators, RTOs, ISOs, Long Term Power Supply	1.5	--	--	--
320-03	Near Term, Day Ahead, Hour Ahead, Real Time Power Supply	1.0	--	--	--
320-04	Ancillary Services	1.0	--	--	--
320-05	Risk Protection	1.0	--	--	--
345-01	NERC Overview and Application for Generator Operators	2.0	--	--	--
345-10	FERC Standards of Conduct (SOC)	1.0	--	--	--
350-01	Elements of System Protection	2.5	1.0	--	--
350-02	Types of Protective Relays	2.5	0.5	--	--
350-03	Monitoring System Conditions	2.5	0.5	--	--
350-04	Disturbance Monitoring Equipment	2.0	1.0	--	--
350-05	Line Protection	1.0	0.5	--	--
350-06	Transformer Protection	1.0	--	--	--
350-07	Pilot Protection	1.0	--	--	--
350-09	Bus Protection	1.5	--	--	--

		CEH	STD	SIM	EO
350-10	Generator Protection	2.5	2.0	--	--
350-11	Protection System Misoperation	1.5	1.0	--	--
350-12	Protection Systems Maintenance Programs	2.0	1.0	--	--
350-14	General Relay Operations and Categories and Input	1.5	--	--	--
350-15	Auxiliary Relays	1.0	1.0	--	--
350-16	Fault Analysis, Relay Coordination, and Back-up Protection	1.5	--	--	--
350-17	Breaker Operations	1.5	--	--	--
350-18	Protection and Control	2.0	2.0	--	--
350-19	Protection and Switching	2.0	--	--	--
350-20	Remedial Action Schemes	1.0	--	--	--
375-12	Real Power Balancing Control Performance (BAL-001)	1.0	1.0	--	✓
375-13	Disturbance Control Performance (BAL-002)	1.0	1.0	--	✓
375-14	Inadvertent Interchange	1.5	1.0	--	✓
375-15	Area Control Error (ACE) Equation	1.5	--	--	--
375-16	Evaluation and Implementation of Interchange Transaction (INT-006)	1.0	1.0	--	✓
375-17	Generation	1.0	--	--	--
375-18	Real Power Balancing Concepts	2.5	2.0	--	--
376-04	Communications (COM-001, COM-002)	1.5	1.5	--	✓
376-05	Principles of Synchrophasors	1.0	--	--	--
376-06	Application of Synchrophasors	1.5	--	--	--
376-07	Overview	1.0	--	--	--
376-08	Effective Verbal Communication	1.0	1.0	--	--
376-09	Effective Written Communication	1.0	1.0	--	--
376-10	Effective Communication Strategies and Best Practices	1.5	--	--	--
377-06	Critical Infrastructure Protection Overview	1.0	1.0	--	--
377-07	CIP Physical and Electronic Access	1.5	1.5	--	--
377-08	CIP Incident Response and Recovery and Supply Chain Risk Management	1.0	1.0	--	--
378-09	Event Reporting and Emergency Operations (EOP-004, EOP-011)	1.0	1.0	--	✓
378-10	System Restart from Blackstart and System Restoration Coordination (EOP-005, EOP-006)	1.0	1.0	--	✓



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		CEH	STD	SIM	EO
378-11	Loss of Control Center and Geomagnetic Disturbance Operation (EOP-008, EOP-010)	1.5	1.5	--	✓
378-12	Energy and Weather Events	1.5	1.5	--	✓
378-13	Energizing and Restoring the Electric System	1.0	1.0	--	✓
378-14	Identifying and Responding to Blackouts	1.0	1.0	--	✓
378-15	Performing System Restoration	1.0	1.0	--	✓
378-18	Blackout Events	1.0	--	--	--
378-19	Geomagnetic Disturbances	2.5	2.0	--	--
381-07	Reliability Coordinator Responsibilities (IRO-001, IRO-008, IRO-009)	2.0	--	--	✓
381-08	Reliability Coordinator Data Needs (IRO-002, IRO-010, IRO-014, IRO-018)	1.5	1.5	--	✓
387-03	Economic Power System Operations	1.0	--	--	--
387-05	Interconnected Energy Accounting	2.0	--	--	✓
387-07	Supervisory Control and Data Acquisition Systems (SCADA)	2.0	--	--	--
387-11	Basics of Power System Operations	1.0	--	--	--
387-12	Human Performance for System Operators	1.5	--	--	--
387-13	Renewable Energy Integration	1.0	1.0	--	✓
387-14	Solar, Hydro, Tidal, Geothermal, and Variable Generation	1.5	--	--	--
387-15	Wind Generation	1.0	--	--	--
387-16	Operations Planning, Monitoring, Analysis (TOP-002, TOP-003, TOP-010)	1.0	1.0	--	✓
387-17	Transmission Operations (TOP-001)	1.0	1.0	--	✓
387-18	Power System Concepts	1.5	--	--	--
387-19	Transmission and Distribution Operations	2.0	--	--	--
387-20	Emergency Response Application with Simulation	1.0	--	0.5	--
387-21	Transmission Stations and Switchyards	1.0	--	--	--
387-22	Transformer Principles	1.0	--	--	--
387-23	Circuit Breakers and Disconnects	1.0	--	--	--
387-24	Transmission Lines, Station Protection, and Monitoring and Control	1.5	--	--	--
387-25	Distribution and Shift Factors	1.0	--	--	--

		CEH	STD	SIM	EO
387-27	Contingency Analysis with Simulation	1.5	--	0.5	--
387-29	Advanced Human Performance for System Operators	1.0	1.0	--	--
387-30	Overview, Interconnected Power System Operations	1.5	--	--	--
387-31	Transmission, Substations, and System Protection	1.5	--	--	--
387-32	Control Center Operations and Governance	1.0	--	--	--
387-33	Basic Electricity Concepts for System Operators	1.0	--	--	--
387-34	Transmission Application with Simulation	1.5	--	0.5	--
387-35	Math for System Operators	1.0	--	--	--
387-37	Human Performance for System Operators - Error Prevention	2.0	0.5	--	--
388-08	Reactive Power Fundamentals	1.0	1.0	--	✓
388-09	Reactive Power Production Equipment	1.0	1.0	--	✓
388-10	Power Control Scenarios	1.0	1.0	--	✓
388-11	Electric Power Principles	1.0	--	--	--
388-12	Voltage and Reactive Control	1.5	1.0	--	--
388-13	Generators and Transmission Lines	1.0	--	--	--
388-14	Generation Operations for Maintaining Network Voltage Schedules	1.0	1.0	--	--
388-15	Voltage and Power Control Equipment	1.5	1.0	--	--
505-02	Steam Turbine Control and Operation	1.5	--	--	✓
507-01	Generator and Auxiliary Systems' Functions	1.0	1.0	--	✓
507-03	Generator Construction and Process Control	1.0	1.0	--	--

NERC
NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

HSI and HSI_SOS_001 are recognized by the North American Electric Reliability Corporation as a continuing education provider who adheres to NERC Continuing Education Program Criteria.

✓ For PER compliance, EO training must be applicable to each individual organization. Please check with your compliance group for eligibility.



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Instructor-Led Courses

	DURATION	CEH	STAND	SIM	E0
Advanced Distribution Concepts	2 day	N/A	–	–	–
Adequate Level of Reliability	4 hrs	4	–	3	–
Analyzing and Mitigating Contingencies: Operational Situational Awareness	1 day	8	1	6	Y
Balancing, Voltage Control, and Congestion Management	1 day	8	2	4	–
Communication, Relay Protection and Emergency Operations	1 day	8	2	4	–
Distribution Systems	3 day	N/A	–	–	–
Effective On-the-Job Training	2 day	N/A	–	–	–
Emergency Operations and Communication	1 day	8	2	3	Y
Emergency Operations Overview	4 hrs	4	3	3	Y
Frequency Response and Balancing	4 hrs	4	2	3	–
Human Performance for System Operators	2 day	16	–	11	Y
Integrating Renewable Energy Resources	4 hrs	4	–	1	–
Managing Power System Reliability	4 hrs	4	–	4	–
NERC Certification: Exam Preparation Instructor-led	3.5 day	28 ‡	19	–	Y
Power System Frequency Impacts and Control	1 day	8	4	4	Y
Presentation Skills	2 day	N/A	–	–	–
Principles for System Reliability	2 day	16	3	6	Y
Procedure Writing	1 day	N/A	–	–	–
Real Power Balancing and Congestion Management	1 day	8	2	3	Y
Relay Protection for System Operation	1 day	8	–	2	–
SAT Complete	3 day	N/A	–	–	–
System Restoration	4 hrs	4	1	3	–
System Restoration	1 day	8	1	6	Y
Voltage Control 1 & 2	2 day	16	4	8	–
Voltage Control 1	1 day	8	3	4	–
Voltage Control 2	1 day	8	1	4	–
Voltage Control and Relay Protection	1 day	8	3	2	Y
Voltage Control Overview	4 hrs	4	2	3	–

‡ NERC Certified Operators with a NERC Certification Number earn the credits/hours shown. All Non-certified Operators are eligible for E0 and Professional hours only.

‡ For PER compliance, E0 training must be applicable to each individual organization. HSI hours are recommendations only. Please check with your compliance group for eligibility.



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DISTRIBUTION OPERATIONS TRAINING helps operators understand the increasingly complex distribution system. Our training provides a working knowledge of how distribution systems are configured and function while addressing electrical fundamentals, reliability control, smart devices, and safety.

Distribution Control Center Operations Training – Level 1

Basic Distribution

301-09	Introduction to Distribution Systems
301-10	Distribution Design and Resource Planning
301-11	Distribution Substation Equipment
301-12	Distribution Protection
301-13	Overvoltage Protection
301-14	SCADA and EMS
301-15	Service Entrance Equipment
301-16	Distribution Normal Operations
301-17	Distribution Emergency Operations

Electrical Safety

301-18	Regulatory Overview and Electrical Safety Principles
301-19	Safe Working Practices
301-20	Arc Flash Analysis and Safety Equipment
301-21	Switching Practices
301-22	Post-storm Electrical Safety

Fundamentals of System Protection

387-03	Interconnected Power System Operations
375-17	Generation
387-31	Transmission, Substation, and System Protection
387-32	Control Center Operations and Governance

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Advanced Distribution

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301-24	Power Quality
301-25	Planned Maintenance and Test Equipment
301-26	Smart Grid System

Distribution Simulation

10 Scenario Bundle

Simulator Orientation Tutorial
Isolating Equipment – Valley Feeder Breaker
Isolating Equipment – Lake Regulator 2
Fault – Lake Feeder 4
Isolating Equipment – Valley Transformer 3
Fault – Ocean Feeder 3
Isolating equipment – Lake Transformer 1
Fault – Lake Feeder 4, Version 2
Fault – Lake Feeder 6, Unguided
Fault – Valley Feeder 2, Unguided

5 Scenario Bundle

Fault – Lake Feeder 4, Unguided
Restoring System – Lake Transformer 1
Fault #2 – Lake Feeder 4, Unguided
Isolated Lake Regulator 2, Unguided
Isolated Valley Transformer3, Unguided

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