



## Martech 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

- 102-02 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 Illnesses

### 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

### 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

### 109 – Rigging Safety

- 109-01 Rigging Safety

### 110 – Scaffolding Safety

- 110-01 Scaffolding Safety

### 111 – Aerial Devices Safety

- 111-01 Scissor Lift Operations and Safety

### 112 – Crane Operations Safety

- 112-01 Crane and Hoist Safety

## Online and Instructor-led Courses | Industrial Skills

### 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 Excavation 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, & 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 Communication 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 Safe Driving 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

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- > 100 Safety, Health, and Plant Science
- > 200 Mechanical Maintenance
- > 300 Electrical Distribution
- > 400 Electrical Maintenance
- > 500 Power Generating Systems and Operations
- > 600 Instrumentation and Control
- > 700 Process Systems and Operations
- > 800 Industrial Machining and Welding
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## SOS

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**131 – Ergonomics**

- 131-01 Ergonomics in an Office Environment
- 131-02 Ergonomics in an Industrial Environment
- 131-03 Proper Lifting Techniques

**140 – Qualified Electrical 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 Stormwater 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

**170 – Industrial Mathematics**

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

**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

**Martech 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
- 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

**211 – Chain Drive Maintenance**

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

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**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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**Martech 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\*

**345 – Introduction to NERC**

- 345-01 NERC Overview and Application for Generator Operators\*
- 345-02 NERC Overview
- 345-03 PER-006 for Generator Operators

**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\*

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| 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*           |
| <b>375 – Resource and Demand Balancing</b>      |  |
| 375-01  | Real Power Balancing Control Performance*          |
| 375-02  | Disturbance Control Performance*                   |
| 375-03  | Frequency Response and Bias*                       |
| 375-05  | Automatic Generation Control*                      |
| <b>376 – Communications</b>                     |  |
| 376-01  | Bulk Power System Communication Basics*            |
| 376-02  | Bulk Power System Communications and Coordination* |
| <b>377 – Critical Infrastructure Protection</b> |  |
| 377-01  | CIP Personnel Responsibilities*                    |
| 377-02  | CIP Perimeters and Configurations*                 |
| 377-03  | Controls and Management*                           |

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| 377-04   | CIP Related BES Recovery Plans*                           |
| 377-05   | CIP Physical Security*                                    |
| <b>378 – Emergency Operations Planning</b>                           |   |
| 378-01   | Emergency Policies and Procedures*                        |
| 378-02   | Capacity and Energy Emergencies                           |
| <b>381 – Interconnection Reliability Operations and Coordination</b> |   |
| 381-05   | Reliability Coordination — Planning and Operations*       |
| 381-06   | Coordinating Entities and Duties*                         |
| <b>387 – System Operations</b>                                       |   |
| 387-01   | Energy Production and Transfers*                          |
| 387-02   | Transmission Operations*                                  |
| 387-03   | Economic Power System Operations*                         |
| 387-04   | Power System Control Elements*                            |
| 387-05   | Interconnected Energy Accounting*                         |
| 387-07   | Supervisory Control and Data Acquisition Systems (SCADA)* |
| 387-10   | Power System Restoration*                                 |
| <b>388 – Active and Reactive Power</b>                               |   |
| 388-01   | Active and Reactive Power Fundamentals*                   |
| 388-02   | Active and Reactive Power Limits and Flows*               |

## Martech 400 – Electrical Maintenance

|                                       |   |
|---------------------------------------|---|
| <b>401 – Direct Current (DC)</b>      |   |
| 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       |
| <b>402 – Alternating Current (AC)</b> |   |
| 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                        |
| <b>405 – Power Quality</b>            |   |
| 405-01                                | Power Quality   |
| 405-02                                | Harmonics   |
| 405-03                                | High-voltage AC                                       |
| <b>409 – Industrial Motors</b>        |   |
| 409-01                                | AC Induction Motors                                   |
| 409-02                                | AC Generators   |
| 409-03                                | AC Induction Motor Theory                             |
| 409-04                                | Troubleshooting AC Induction Motors                   |

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| 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 |
| <b>411 – Motor Control and Protection</b>         |   |
| 411-01  | Introduction to Motor Controls                      |
| 411-02  | Motor Protection and Faults                         |
| 411-03  | Motor Control Troubleshooting                       |
| 411-04  | Motor Control Centers                               |
| <b>413 – AC Drives</b>                            |   |
| 413-01  | AC Drives Overview                                  |
| <b>415 – Transformers</b>                         |   |
| 415-01  | Transformer Basics                                  |
| 415-02  | Transformer Design and Components                   |
| 415-03  | Transformer Connections                             |
| 415-04  | Special Transformers                                |
| <b>416 – Batteries, Battery Chargers, and UPS</b> |   |
| 416-01  | Battery Basics                                      |
| 416-02  | Electrical Backup Systems                           |
| 416-03  | Uninterruptible Power Supplies (UPS)                |

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| <b>417 – Switchgear Maintenance</b>              |   |
| 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 |
| <b>418 – Electrical Protection and Grounding</b> |   |
| 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                                   |
| <b>419 – Motor Operated Valves</b>               |   |
| 419-01   | MOV (Motor Operated Valve) Application and Construction |
| 419-02   | MOV Disassembly and Inspection, Part 1                  |

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| 419-03   | MOV Disassembly and Inspection, Part 2                  |
| 419-04   | Limit Switch Adjustment                                 |
| <b>421 – Wiring Installation</b>                 |   |
| 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                     |
| <b>423 – Cable Splicing</b>                      |   |
| 423-01   | Introduction to Medium Voltage Cable                    |
| 423-02   | Medium Voltage Splices and Terminations                 |
| <b>425 – Troubleshooting Electrical Circuits</b> |   |
| 425-01   | Troubleshooting AC Circuits                             |
| 425-02   | Troubleshooting DC Circuits                             |
| <b>427 – Freeze Protection</b>                   |   |
| 427-01   | Electrical Freeze Protection Components and Application |

## Martech 500 – Power Generating Systems and Operations

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| <b>501 – Power Generation</b>                            |   |
| 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  |
| <b>505 – Turbine Auxiliaries System and Control</b>      |   |
| 505-01   | Steam Turbine Design  |
| 505-02   | Steam Turbine Control and Operation*                                |
| 505-03   | Steam Turbine Auxiliaries   |
| 505-10   | Steam Turbine Governor System                                       |
| <b>507 – Generator and Auxiliary Systems and Control</b> |   |
| 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                           |
| <b>511 – Combustion Turbine Fundamentals</b>             |   |
| 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      |

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| 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                            |
| <b>521 – Combustion Air and Flue Gas System</b> |   |
| 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                 |
| <b>522 – Coal Handling System</b>               |   |
| 522-01  | Coal Handling System  |
| <b>523 – Boiler Fuel Systems</b>                |   |
| 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 for the Boiler Fuel System                                 |
| <b>531 – Hydrocarbon Fired Boilers</b>          |   |
| 531-01  | Combustion Theory   |
| 531-02  | Basic Boiler Design   |

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| 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                      |
| <b>533 – Boiler Firing Controls and Components</b>    |   |
| 533-01  | Fuel Combustion and Controls                                    |
| 533-02  | Boiler Burner Controls and Management                           |
| <b>535 – Fundamental Aspects of Emission Controls</b> |   |
| 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 Lesson                                   |
| 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                                  |
| <b>551 – Circulating Water System</b>                 |   |
| 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   |
| <b>553 – Condensate and Feedwater Systems</b>         |   |
| 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                         |
| <b>555 – Boiler Feed Pumps</b>                        |   |
| 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 Start-up                                       |
| 555-05  | Boiler Feed Pump Daily Operations                               |
| <b>557 – Boiler Water and Steam Systems</b>           |   |
| 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  | Start-up 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                  |

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| <b>559 – Water Treatment</b>   |  |
| 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                              |
| <b>560 – Plant Electrical Systems</b>  |  |
| 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                            |
| <b>561 – Unit Start-up and Shutdown</b>  |  |
| 561-01   | Preparing for Power Plant Start-ups                            |
| 561-02   | Power Plant Start-up Procedures                                |
| 561-03   | Preparing for Power Plant Shutdown                             |
| 561-04   | Power Plant Shutdown Procedures                                |
| <b>563 – Efficiency, Reliability, and Environmentally Sensitive Operations</b> |  |
| 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                           |
| <b>565 – Plant Control System</b>  |  |
| 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                                       |
| <b>567 – Heat Rate Optimization</b>  |  |
| 567-01   | Basic Principles of Water and Steam                            |
| 567-02   | Saturated Steam Tables   |
| 567-03   | Superheated Steam Tables                                       |

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| <b>581 – Diesel Power Plant Operations</b>         |   |
| 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                        |
| <b>582 – Combined Cycle Power Plant Operations</b> |   |
| 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                |
| 582-13   | Control Loops in a Combined Cycle Plant                 |
| <b>583 – Hydroelectric Power Plant Operations</b>  |   |
| 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 |

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| 583-08   | Mechanical Governor                                    |
| 583-09   | Electric Governor                                      |
| <b>584 – Biomass Energy</b>                    |  |
| 584-02   | Biomass and Waste to Energy Power Plants               |
| <b>585 – Wind Energy</b>                       |  |
| 585-01   | Basic Wind Turbine Design                              |
| 585-02   | Wind Farm Development                                  |
| 585-03   | Horizontal Wind Turbine Design and Operation           |
| 585-04   | Wind Energy Production                                 |
| <b>586 – Reciprocating Engine Power Plants</b> |  |
| 586-01   | Introduction to Reciprocating Engine Power Plants      |
| 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                |
| <b>587 – Nuclear Energy</b>                    |  |
| 587-01   | Nuclear Power Principles and Designs                   |
| 587-02   | PWR and BWR Operation and Design                       |
| <b>589 – Solar Energy</b>                      |  |
| 589-01   | Introduction to Solar Energy                           |
| 589-03   | Solar Energy - Photovoltaic                            |
| 589-05   | Solar Energy – Thermal Applications                    |

## Martech 600 – Instrumentation and Control

|  |                                      |
|--|--------------------------------------|
| <b>603 – Process Control Variables</b> |                                      |
| 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             |
| <b>605 – Test Equipment</b>            |                                      |
| 605-01                                 | Multimeter                           |
| 605-02                                 | Oscilloscopes                        |
| 605-03                                 | Power Supplies                       |
| 605-04                                 | Signal Generators                    |
| 605-05                                 | Temperature and Loop Calibrators     |
| 605-06                                 | Manometers                           |

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| 605-07                                       | Pressure and Vacuum Calibrators    |
| 605-08                                       | Megohmmeter                        |
| <b>607 – Analyzers</b>                       |                                    |
| 607-01                                       | Analytical Instruments             |
| 607-02                                       | Introduction to Analytical Testing |
| <b>609 – Calibration and Troubleshooting</b> |                                    |
| 609-01                                       | Calibration Overview, Part 1       |
| 609-02                                       | Calibration Overview, Part 2       |
| 609-03                                       | Introduction to Troubleshooting    |
| 609-04                                       | Instrument Troubleshooting         |
| <b>611 – Prints and Drawings</b>             |                                    |
| 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  |

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| <b>613 – Automated Control</b>                  |  |
| 613-01  | Introduction to Automated Control                    |
| 613-02  | Pneumatic Control Systems                            |
| 613-03  | Introduction to Switches                             |
| 613-04  | Electronic Control Systems                           |
| <b>615 – Signal Transmission and Conversion</b> |  |
| 615-01  | Signal Transmission                                  |
| 615-02  | Basic Principles of Industrial Transmitters          |
| 615-03  | Smart Transmitters                                   |
| 615-04  | Transducers  |
| <b>617 – Controllers and Final Control</b>      |  |
| 617-01  | Controller Control Modes                             |
| 617-02  | Operation of Automatic-Manual Transfer Stations      |
| 617-03  | Final Control Elements                               |
| <b>619 – Electronics Fundamentals</b>           |  |
| 619-01  | Introduction to Industrial Electronics               |
| 619-07  | Digital Electronics and Microprocessors              |
| <b>621 – Programmable Logic Controllers</b>     |  |
| 621-01  | Introduction to Programmable Logic Controllers (PLC) |
| 621-02  | Input/Output (I/O) Processing                        |

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|---|---|
| 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   |
| <b>670 – Heating &amp; Cooling Fundamentals</b> |   |
| 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          |

## Martech 700 – Process Systems and Operations

|                                 |   |
|---------------------------------|---|
| <b>701 – Petroleum Refining</b> |   |
| 701-01                          | Introduction to Petroleum Refining        |
| 701-02                          | Basic Petroleum Chemistry                 |
| 701-03                          | OSHA's Process Safety Management Standard |
| 701-04                          | History of Refining                       |
| <b>705 Refining Operations</b>  |   |
| 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                         |
| 705-13                          | Sweeting                                  |
| 705-15                          | Sulfuric Acid Plant                       |
| <b>707 – Process Heaters</b>    |   |
| 707-01                          | Features and Operation of Process Heaters |
| <b>709 – Process Tanks</b>      |   |
| 709-01                          | Features and Uses of Process Tanks        |
| <b>711 – Distillation</b>       |   |
| 711-01                          | Introduction to Distillation              |
| 711-02                          | Operation of a Distillation Column        |

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| <b>713 – Process Separators</b>                   |  |
| 713-01  | Introduction to Process Separators       |
| <b>715 – Process Reactors</b>                     |  |
| 715-01  | Introduction to Process Reactors         |
| <b>717 – Reforming and Synthesis</b>              |  |
| 717-01  | Introduction to Naphtha Reforming        |
| <b>719 – Process Safety Systems</b>               |  |
| 719-01  | Safety Alarm Systems and Instrumentation |
| 719-02  | Overpressure Safety Systems              |
| <b>721 – Process Utilities Systems</b>            |  |
| 721-01  | Process Utilities Systems, Part 1        |
| 721-02  | Process Utilities Systems, Part 2        |
| <b>723 – Process Product Movement and Storage</b> |  |
| 723-01  | Process Product Movement and Shipment    |
| 723-02  | Tanks and Vessels Used for Storage       |
| <b>725 – Process Sampling and Testing</b>         |  |
| 725-01  | Sampling Principles and Methods          |
| 725-02  | Testing Principles and Procedures        |

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**Martech 800 – Industrial Machining and Welding**

|                                       |  |
|---------------------------------------|--|
| <b>801 – Precision Measurement</b>    |  |
| 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                             |
| <b>803 – Layout and Bench Work</b>    |  |
| 803-01                                | Layout and Bench Work                          |
| 803-02                                | Threading and Tapping                          |
| <b>805 – Vertical Milling Machine</b> |  |
| 805-01                                | Vertical Milling Machine                       |
| <b>807 – Engine Lathe</b>             |  |
| 807-01                                | Engine Lathe                                   |
| <b>809 – Surface Grinder</b>          |  |
| 809-01                                | Surface Grinder                                |
| <b>811 – Pedestal Grinder</b>         |  |
| 811-01                                | Pedestal Grinder                               |

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|---|------------------------------------|
| <b>813 – Bandsaw</b>                                      |                                    |
| 813-01  | Band saw                           |
| <b>815 – Drill Press</b>                                  |                                    |
| 815-01  | Drill Press                        |
| <b>820 – Rigging, Lifting, and Elevated Work Surfaces</b> |                                    |
| 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                |
| <b>841 – Welding and Cutting for Maintenance</b>          |                                    |
| 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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|--------|---|
| 301-02 | Electrical Distribution System Fundamentals<br>CEH: 2.0 STD: -- SIM: 1.0 EO: --           |
| 301-06 | Load Characteristics and Management<br>CEH: 1.5 STD: 1.0 SIM: -- EO: --                   |
| 301-08 | Single and Poly-Phase Metering<br>CEH: 1.5 STD: -- SIM: -- EO: --                         |
| 345-01 | NERC Overview and Application for Generator Operators<br>CEH: 2.0 STD: 2.0 SIM: -- EO: -- |
| 350-01 | Elements of System Protection<br>CEH: 2.5 STD: 1.0 SIM: -- EO: --                         |
| 350-02 | Types of Protective Relays<br>CEH: 2.5 STD: 0.5 SIM: -- EO: --                            |
| 350-03 | Monitoring System Conditions<br>CEH: 2.5 STD: 0.5 SIM: -- EO: --                          |
| 350-04 | Disturbance Monitoring Equipment<br>CEH: 2.0 STD: 1.0 SIM: -- EO: --                      |
| 350-05 | Line Protection<br>CEH: 1.0 STD: 1.5 SIM: -- EO: --                                       |
| 350-06 | Transformer Protection<br>CEH: 1.0 STD: -- SIM: -- EO: --                                 |

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| 350-07 | Pilot Protection<br>CEH: 1.5 STD: -- SIM: -- EO: --                         |
| 350-09 | Bus Protection<br>CEH: 1.5 STD: -- SIM: -- EO: --                           |
| 350-10 | Generator Protection<br>CEH: 2.5 STD: 2.0 SIM: -- EO: --                    |
| 350-11 | Protection System Misoperation<br>CEH: 1.5 STD: 1.0 SIM: -- EO: --          |
| 350-12 | Protection Systems Maintenance Programs<br>CEH: 2.0 STD: 1.0 SIM: -- EO: -- |
| 375-01 | Real Power Balancing Control Performance<br>CEH: 3.0 STD: 3.0 SIM: -- EO: ✓ |
| 375-02 | Disturbance Control Performance<br>CEH: 2.0 STD: 1.0 SIM: -- EO: --         |
| 375-03 | Frequency Response and Bias<br>CEH: 2.0 STD: 1.0 SIM: -- EO: ✓              |
| 375-05 | Automatic Generation Control<br>CEH: 3.0 STD: 1.0 SIM: -- EO: --            |
| 376-01 | Bulk Power System Communication Basics<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --  |

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| 376-02 | Bulk Power System Communications and Coordination<br>CEH: 2.5 STD: 2.0 SIM: 1.5 EO: ✓ |
| 377-01 | CIP Personnel Responsibilities<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --                    |
| 377-02 | CIP Perimeters and Configurations<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --                 |
| 377-03 | Controls and Management<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --                           |
| 377-04 | CIP Related BES Recovery Plans<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --                    |
| 377-05 | CIP Physical Security<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --                             |
| 378-01 | Emergency Policies and Procedures<br>CEH: 1.5 STD: 1.5 SIM: -- EO: --                 |
| 381-05 | Reliability Coordination — Planning and Operations<br>CEH: 1.5 STD: -- SIM: -- EO: -- |
| 381-06 | Coordinating Entities and Duties<br>CEH: 1.5 STD: -- SIM: -- EO: --                   |
| 387-01 | Energy Production and Transfers<br>CEH: 1.5 STD: 1.5 SIM: -- EO: --                   |
| 387-02 | Transmission Operations<br>CEH: 2.5 STD: 1.0 SIM: -- EO: --                           |
| 387-03 | Economic Power System Operations<br>CEH: 2.0 STD: -- SIM: -- EO: ✓                    |
| 387-04 | Power System Control Elements<br>CEH: 1.5 STD: -- SIM: -- EO: ✓                       |

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| 387-05 | Interconnected Energy Accounting<br>CEH: 2.0 STD: -- SIM: -- EO: ✓                          |
| 387-07 | Supervisory Control and Data Acquisition Systems (SCADA)<br>CEH: 2.0 STD: -- SIM: -- EO: -- |
| 387-10 | Power System Restoration<br>CEH: 2.0 STD: 2.0 SIM: -- EO: --                                |
| 388-01 | Active and Reactive Power Fundamentals<br>CEH: 2.0 STD: 2.0 SIM: -- EO: ✓                   |
| 388-02 | Active and Reactive Power Limits and Flows<br>CEH: 2.0 STD: 2.0 SIM: 1.0 EO: ✓              |
| 417-01 | Switchgear<br>CEH: 2.0 STD: -- SIM: -- EO: --   |
| 417-02 | Low Voltage Breakers<br>CEH: 1.0 STD: -- SIM: -- EO: --                                     |
| 417-03 | Medium and High Voltage Switchgear<br>CEH: 2.0 STD: -- SIM: -- EO: --                       |
| 505-02 | Steam Turbine Control and Operation<br>CEH: 1.5 STD: -- SIM: -- EO: ✓                       |
| 507-01 | Generator and Auxiliary Systems' Functions<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓               |
| 507-03 | Generator Construction and Process Control<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --              |
| 560-01 | Main Transformers<br>CEH: 1.5 STD: 1.5 SIM: -- EO: ✓  |

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|---|
| <b>Area Control Error Equation</b>  |
| Area Control Error Equation<br>CEH: 1.0 STD: -- SIM: -- EO: --                                      |
| <b>Balancing, Interchange, AGC</b>  |
| Balancing, Interchange, AGC<br>CEH: 2.5 STD: -- SIM: 1.5 EO: ✓                                      |
| <b>Basic Electricity Fundamentals</b>   |
| Basic Electricity<br>CEH: 1.0 STD: -- SIM: -- EO: --  |
| Laws of Electricity<br>CEH: 1.0 STD: -- SIM: -- EO: --  |
| AC, DC, and Circuit Interactions<br>CEH: 1.0 STD: -- SIM: -- EO: --                                 |
| Three-Phase AC Connections and Effects<br>CEH: 1.0 STD: -- SIM: -- EO: --                           |
| Electric Devices<br>CEH: 1.0 STD: -- SIM: -- EO: --   |
| <b>Basics of Power System Operations</b>  |
| Basics of Power System Operations<br>CEH: 1.0 STD: -- SIM: -- EO: --                                |
| <b>Blackout Events</b>  |
| Blackout Events<br>CEH: 1.0 STD: -- SIM: -- EO: --  |
| <b>Communications</b>   |
| Communications<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓   |
| <b>Communication</b>  |
| Communications (COM-001, COM-002)<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓                                |
| <b>Contingency Analysis</b>   |
| Contingency Analysis<br>CEH: 3.0 STD: -- SIM: 1.5 EO: ✓   |
| <b>Contingency Analysis with Simulation</b>   |
| Contingency Analysis with Simulation<br>CEH: 1.5 STD: -- SIM: 0.5 EO: ✓                             |
| <b>Critical Infrastructure Protection Version 7</b>   |
| Critical Infrastructure Protection Overview<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --                     |
| Physical and Electronic Access<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --                                  |
| Incident Response and Recovery and Supply Chain Risk Management<br>CEH: 1.0 STD: 1.0 SIM: -- EO: -- |
| <b>Distribution and Shift Factors</b>   |
| Distribution and Shift Factors<br>CEH: 1.0 STD: -- SIM: -- EO: --                                   |

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| <b>Effective Communications</b>  |
| Overview<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --   |
| Effective Verbal Communication<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --   |
| Effective Written Communication<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --  |
| Effective Communication Strategies and Best Practices<br>CEH: 1.5 STD: 1.0 SIM: -- EO: --  |
| <b>Electric Power Principles</b>   |
| Ohm's Law, Power and Energy Formulas & Basic Concepts of Series and Parallel Circuits<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓         |
| Formulas for Voltage and Current Division<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓   |
| Inductance, Capacitance, and Phase and Power Angles<br>CEH: 1.5 STD: 1.5 SIM: -- EO: ✓   |
| Phasors, Capacitance, Inductance, and Symmetrical Components<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓                                  |
| Electromagnetism, Induction, Transformers, and Conductors<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓                                     |
| Generators, Torque Angle, and Synchronizing<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓   |
| <b>Electric System Restoration</b>   |
| Energizing and Restoring the Electric System<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --   |
| Identifying and Responding to Blackouts<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓   |
| Performing System Restoration<br>CEH: 1.0 STD: 1.0 SIM: -- EO: --  |
| <b>Emergency Preparedness and Operations</b>   |
| Emergency Operations and Event Reporting (EOP-004, EOP-011)<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓                                   |
| Loss of Control Center Functionality and Geomagnetic Disturbance Operation (EOP-008, EOP-010)<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓ |
| System Restoration Coordination and System Restoration from Blackstart (EOP-005, EOP-006)<br>CEH: 1.0 STD: 1.0 SIM: -- EO: ✓     |
| <b>Emergency Response Application with Simulation</b>  |
| Emergency Response Application with Simulation<br>CEH: 1.0 STD: -- SIM: 0.5 EO: ✓  |
| <b>Energy and Weather Event Summary</b>  |
| Energy and Weather Event Summary<br>CEH: 1.5 STD: -- SIM: -- EO: ✓   |

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- > 400 Electrical Maintenance
- > 500 Power Generating Systems and Operations
- > 600 Instrumentation and Control
- > 700 Process Systems and Operations
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SOS

- > Online - CEH
- > Online Non-CEH
- > Distribution Online Non-CEH
- > Instructor Led

**FERC Standards of Conduct (SOC)**

FERC Standards of Conduct (SOC)  
CEH: 1.0 STD: -- SIM: -- EO: --

**Fundamentals of System Protection**

General Relay Operations and Categories and Input  
CEH: 1.5 STD: 1.5 SIM: -- EO: --

Auxiliary Relays

CEH: 1.0 STD: 1.0 SIM: -- EO: --

Fault Analysis, Relay Coordination, and Back-up Protection

CEH: 1.5 STD: 1.5 SIM: -- EO: --

Remedial Action Schemes

CEH: 1.0 STD: -- SIM: -- EO: --

Breaker Operations

CEH: 1.5 STD: -- SIM: -- EO: --

**Generators and Frequency**

Generators and Frequency  
CEH: 2.5 STD: -- SIM: 1.5 EO: ✓

**Geomagnetic Disturbances**

Geomagnetic Disturbances  
CEH: 1.5 STD: -- SIM: -- EO: --

**Human Performance for System Operators**

Human Performance for System Operators  
CEH: 1.5 STD: -- SIM: -- EO: --

**Human Performance for System Operators: Advanced Concepts**

Advanced Human Performance for System Operators  
CEH: 1.0 STD: 1.0 SIM: -- EO: --

**Interchange Scheduling and Coordination**

Interchange Scheduling and Coordination  
CEH: 1.0 STD: 1.0 SIM: -- EO: ✓

**Interconnection Reliability Operations and Coordination**

Reliability Coordinator Responsibilities (IRO-001, IRO-006, IRO-008, IRO-009)  
CEH: 2.0 STD: 1.5 SIM: -- EO: ✓

Reliability Coordinator Data Need (IRO-002, IRO-010, IRO-014, IRO-017, IRO-018)  
CEH: TBD\* STD: -- SIM: -- EO: ✓

**Math for System Operators**

Math for System Operators  
CEH: 1.0 STD: -- SIM: -- EO: ✓

**Power Flow and Distribution Factors**

Power Flow and Distribution Factors  
CEH: 3.0 STD: -- SIM: 2.0 EO: ✓

**Power System Fundamentals**

Interconnected Power System Operations Overview  
CEH: 1.5 STD: -- SIM: -- EO: --

Generation

CEH: 1.0 STD: -- SIM: -- EO: --

Transmission, Substations, and System Protection:

CEH: 1.5\* STD: -- SIM: -- EO: --

Control Center Operations and Governance

CEH: 1.0\* STD: -- SIM: -- EO: --

**Power System Operation Orientation**

Power System Operations Orientation  
CEH: 1.0 STD: -- SIM: 1.0 EO: ✓

**Protection and Control**

Protection and Control  
CEH: 2.0 STD: 2.0 SIM: -- EO: --

**Reactive Power Fundamentals and Voltage Control**

Reactive Power Fundamentals  
CEH: 1.0 STD: 1.0 SIM: -- EO: ✓

Reactive Power Production Equipment

CEH: 1.0 STD: 1.0 SIM: -- EO: ✓

Power Control Scenarios

CEH: 1.0 STD: 1.0 SIM: -- EO: ✓

**Renewable Energy Integration**

Renewable Energy Integration  
CEH: 1.0 STD: 1.0 SIM: -- EO: ✓

**Renewable Energy Resources**

Renewable Energy Resources Training  
CEH: 1.5 STD: -- SIM: -- EO: --

Renewable Energy Resources Wind Generation

CEH: 1.0 STD: -- SIM: -- EO: ✓

**Resource and Demand Balancing**

Real Power Balancing Control Performance (BAL-001)

CEH: 1.0 STD: 1.0 SIM: -- EO: --

Disturbance Control Performance (BAL-002)

CEH: 1.0 STD: 1.0 SIM: -- EO: --

Frequency Response and Bias Setting and Balancing Authority Control (BAL-003)

CEH: 1.5 STD: 1.0 SIM: -- EO: --

**Restoration**

Restoration  
CEH: 3.5 STD: -- SIM: 2.0 EO: ✓

**Synchrophasors**

Principles of Synchrophasors  
CEH: 1.0 STD: -- SIM: -- EO: ✓

Application of Synchrophasors

CEH: 1.5 STD: -- SIM: -- EO: ✓

**System Operating Limits**

System Operating Limits  
CEH: 3.0 STD: -- SIM: 2.5 EO: ✓

**Switching**

Switching  
CEH: 3.0 STD: -- SIM: 1.5 EO: ✓

**MARTECH**

› 100 Safety, Health, and Plant Science

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\* CEH total pending NERC approval.

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**Transmission and Distribution Concepts**

Power System Concepts  
CEH: 1.5 STD: -- SIM: -- EO: --

Transmission and Distribution Operations  
CEH: 2.0 STD: -- SIM: -- EO: --

Protection and Switching  
CEH: 2.0 STD: -- SIM: -- EO: --

**Transmission Application with Simulation**

Transmission Application with Simulation  
CEH: 1.5 STD: -- SIM: 0.5 EO: ✓

**Transmission Fundamentals**

Transmission Stations and Switchyards  
CEH: 1.0 STD: -- SIM: -- EO: --

Transformer Principles  
CEH: 1.0 STD: -- SIM: -- EO: --

Circuit Breakers and Disconnects  
CEH: 1.0 STD: -- SIM: -- EO: --

Transmission Lines, Station Protection, and Monitoring and Control Equipment  
CEH: 1.0 STD: -- SIM: -- EO: --

**Transmission Operations**

Transmission Operations (TOP-001)  
CEH: 1.0 STD: 1.0 SIM: -- EO: --

Operations Planning, Monitoring, Analysis (TOP-002, TOP-003, TOP-010)  
CEH: 1.0 STD: 1.0 SIM: -- EO: --

**SOS – Online: Non-CEH**

Compliance Awareness  
Human Error Prevention  
Math for Energy Professionals

**Understanding Power Markets**

Market Concepts  
CEH: 1.0 STD: -- SIM: -- EO: --

Long Term Power Scheduling  
CEH: 1.5 STD: -- SIM: -- EO: --

Short Term Power Scheduling  
CEH: 1.0 STD: -- SIM: -- EO: --

UPM Ancillary Services  
CEH: 1.0 STD: -- SIM: -- EO: --

UPM Risk Protection  
CEH: 1.0 STD: -- SIM: -- EO: --

**Voltage and Reactive Control**

Voltage and Reactive Control (VAR-001)  
CEH: 1.5 STD: 1.5 SIM: -- EO: ✓

Generation Operations for Maintaining Network Voltage Schedules (VAR-002)  
CEH: 1.0 STD: 1.0 SIM: -- EO: ✓

**Voltage and Transmission**

Voltage and Transmission  
CEH: 3.0 STD: -- SIM: 2.0 EO: ✓

**Voltage Control**

Electric Power Principles  
CEH: 1.0 STD: -- SIM: -- EO: ✓

Generators and Transmission Lines  
CEH: 1.0 STD: -- SIM: -- EO: ✓

Voltage and Power Control Equipment  
CEH: 1.0 STD: -- SIM: -- EO: ✓

Power Plant Principles  
Reliability and Functional Entities  
Systematic Approach to Training Overview

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## SOS – Distribution Online: Non-CEH

### Distribution Overview

#### Distribution Control Center Operations Training – Level 1

- **Basic Distribution**

- Introduction to Distribution Systems
- Distribution Design and Resource Planning
- Distribution Substation Equipment
- Distribution Protection
- Overvoltage Protection
- SCADA and EMS
- Service Entrance Equipment
- Distribution Normal Operations
- Distribution Emergency Operations

- **Electrical Safety**

- Regulatory Overview and Electrical Safety Principles
- Safe Working Practices
- Arc Flash Analysis and Safety Equipment
- Switching Practices
- Post-storm Electrical Safety

- **Fundamentals of System Protection:**

- Interconnected Power System Operations
- Generation
- Transmission
- Substation and System Protection
- Control Center Operations
- Governance

#### Distribution Control Center Operations Training – Level 2

- **Advanced Distribution**

- Distribution Reliability
- Power Quality
- Planned Maintenance and Test Equipment
- Smart Grid Systems

#### Electrical Distribution SIMULATOR – 10 Scenario Bundle

1. Simulator Orientation Tutorial
2. Isolating Equipment – Valley Feeder Breaker
3. Isolating Equipment – Lake Regulator 2]
4. Fault – Lake Feeder 4
5. Isolating Equipment – Valley Transformer 3
6. Fault – Ocean Feeder 3
7. Isolating Equipment – Lake Transformer 1
8. Fault – Lake Feeder 4, Version 2
9. Fault – Lake Feeder 6, Unguided
10. Fault – Valley Feeder 2, Unguided

#### Electrical Distribution SIMULATOR – 5 Scenario Bundle

1. Fault – Lake Feeder 4, Unguided
2. Restoring System – Lake Transformer 1
3. Fault #2 – Lake Feeder 4, Unguided
4. Isolated Lake Regulator 2, Unguided
5. Isolated Valley Transformer 3, Unguided

## SOS – Instructor-led

#### Advanced Distribution Concepts – 2 day

Adequate Level of Reliability – 4 hours

CEH: 4.0 STD: -- SIM: 3.0 EO: --

#### Analyzing and Mitigating Contingencies:

Operational Situational Awareness – 2 day

CEH: 16.0 STD: 16.0 SIM: 12.0 EO: ✓

#### Analyzing and Mitigating Contingencies:

Operational Situational Awareness – 1 day

CEH: 8.0 STD: 8.0 SIM: 6.0 EO: ✓

#### Distribution Systems – 3 day

Effective Communication for System Operators – 1 day

CEH: 8.0 STD: 3.0 SIM: -- EO: ✓

#### Effective On-the-Job Training – 2 day

Emergency Preparedness and Operation Standards – 1 day

CEH: 8.0 STD: 4.0 SIM: 4.0 EO: ✓

#### Emergency Operations Overview – 4 hours

CEH: 4.0 STD: 3.0 SIM: 3.0 EO: --

#### Frequency Response and Balancing – 4 hours

CEH: 4.0 STD: 2.0 SIM: 3.0 EO: --

#### Human Performance for System Operators – 2 day

CEH: 16.0 STD: TBD SIM: -- EO: --

#### Industrial Electrical Safety, Grounding and Switching – 3 day

#### Internal Controls – 1 day

Introduction to Power System Operations – 3 day

CEH: 24.0 STD: 14.0 SIM: -- EO: ✓

#### Mentoring – 1 day

Power System Frequency Impacts and Control – 1 day

CEH: 8.0 STD: -- SIM: 4.0 EO: ✓

#### Presentation Skills – 2 day

Principles for System Reliability:

Generation, Transmission and Critical Decision Making – 4 day

CEH: 32.0 STD: 8.0 SIM: 16.0 EO: ✓

#### Procedure Writing – 1 day

Systematic Approach to Training Complete – 3 day

System Restoration – 1 day

CEH: 8.0 STD: -- SIM: 4.0 EO: --

Voltage Control 1 and 2 – 2 day

CEH: 16.0 STD: 4.0 SIM: 8.0 EO: ✓

Voltage Control Overview – 4 hours

CEH: 4.0 STD: 2.0 SIM: 3.0 EO: --

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