Data Center Operations Foundations Course Description

Overview

Data Center Operations Foundations is a foundational course introducing practical concepts used in data center operations and critical facilities work. By the end of the course, learners are expected to explain data center basics and critical facility roles; demonstrate safety-first and professional behavior; understand key electrical and mechanical (HVAC) concepts; recognize monitoring, alarms, and response procedures; follow standard operating and emergency procedures; use technical documentation and basic tools; and prepare for entry-level critical facilities roles.

Available Curriculum Languages:

- English

Duration

- Recommended total course time: 60 hours*
- Suggested schedule: 18 weeks; 2 sessions/week; 90 minutes/session (≈ 3 instructional hours/week)

  **Course time may include instruction, guided practice, scenario simulations, projects, self-study/homework, and assessments*

Target Audiences

Educators

- Technical, vocational, and community college faculty members who teach industrial technology, facilities, engineering technology, STEM, ICT, or related subjects
- Secondary and vocational school teachers supporting CTE pathways in industrial operations, energy systems, or infrastructure careers

Students

- Students who wish to learn the concepts and behaviors required for entry-level data center critical facilities operations roles
- Students who possess basic mathematical, logical, and analytical problem-solving skills

- Students exploring industrial operations careers who benefit from a safety-first, procedures-based learning environment
- This foundational course is suitable for technical and non-technical learners alike

Prerequisites

Suggested

- Comfort using a laptop for quizzes and written responses
- Ability to interpret basic diagrams and follow step-by-step procedures
- Basic math readiness (units, ratios, simple calculations)

Suggested Next Courses

- Facilities Operations: Advanced Monitoring & Incident Response (tabletop/simulation-based)
- Intro to Industrial Electricity (lab-based, trade pathway)
- Intro to HVAC/R (lab-based, trade pathway)

Lesson-by-Lesson Topics and Objectives

Section 1 - Introduction to Data Centers & Critical Facilities

1-1 Course Introduction

- Identify the course goals and objectives
- Understand how the course is organized into modules and lessons
- Understand course expectations (participation, professionalism, safety-first mindset)
- Understand how projects, practices, and assessments will be used in the course

1-2 What is a Data Center?

- Define a data center in practical terms
- Explain why uptime matters
- Describe what “critical infrastructure” means in the context of data centers

1-3 Data Center Types, IT Vs Facilities, and Critical Facilities Roles

- Compare hyperscale vs colocation vs enterprise
- Explain the difference between IT responsibilities and Facilities responsibilities
- Identify key Critical Facilities roles at a high level: CFT, Operating Engineer, and Shift Lead

1-4 Redundancy (N, N+1, 2N)

- Define redundancy and interpret N, N+1, and 2N
- Explain how redundancy supports uptime
- Describe what can happen operationally when cooling fails

Section 2 - Safety & Professionalism in Industrial Environments (Gate)

2-1 Industrial Hazards and PPE Fundamentals

- Understand common industrial hazards
- Demonstrate safety-first thinking
- Understand why procedures exist

2-2 Lockout/Tagout and Arc Flash Awareness

- Understand Lockout/Tagout (conceptual, not trade certification)
- Understand arc flash awareness (what it is, why it matters)
- Distinguish electrical hazards from mechanical hazards

2-3 Incident Reporting, Stop-Work Authority, and Safety Gate Quiz

- Demonstrate professional communication during incidents
- Understand chain of command during escalation
- Understand incident reporting and stop-work authority expectations
- Complete the Safety Gate Quiz requirement for Module 2

Section 3 - Basic Electrical Theory

3-1 AC vs. DC and Core Electrical Terms (Voltage, Current, Resistance)

- Understand how electrical power flows at a basic level
- Use correct electrical terminology (AC, DC, voltage, current, resistance)
- Apply basic electrical concepts to data center facilities contexts

3-2 Single-Phase vs Three-Phase Power

- Understand the difference between single-phase and three-phase power
- Use correct terminology when discussing phases in a facilities context
- Explain why three-phase power is common in data centers

3-3 Breakers, Transformers, Switchgear, Grounding, and Bonding

- Recognize major electrical distribution components used in facilities environments
- Use correct terminology for breakers, transformers, and switchgear
- Explain why grounding and bonding matter for safety and reliable operations

3-4 UPS and Generators in Backup Power

- Understand what a UPS does and why it exists
- Understand what a generator does and why it exists
- Read a simplified one-line diagram at a basic level

Section 4 - Mechanical Systems & HVAC Fundamentals

4-1 Heat Transfer Basics and Why Cooling is Critical

- Understand basic heat transfer concepts in a data center context
- Understand why cooling failures are critical to uptime and equipment protection
- Identify high-level operational priorities during rising temperature conditions

4-2 Airflow vs Water-Based Cooling and CRAC/CRAH Units

- Understand the difference between airflow-based and water-based cooling concepts
- Identify what CRAC and CRAH units are and why they are used in data centers
- Explain why airflow management is critical to cooling effectiveness

4-3 Chillers, Cooling Towers, and Piping Basics

- Identify major water-based cooling components used in data centers
- Understand what chillers and cooling towers do at a high level
- Recognize why pumps, valves, and piping basics matter to cooling reliability

4-4 Cooling Redundancy and Environmental Monitoring

- Understand why redundancy is used in cooling systems
- Recognize how environmental monitoring supports safe, reliable operations
- Identify high-level response priorities when temperature or humidity conditions move outside normal ranges

Section 5 - Controls, Monitoring & Alarms

5-1 Building Management Systems (BMS) and Sensors

- Understand how facility systems are monitored in a data center
- Understand what a Building Management System (BMS) is and why it matters
- Identify common sensor types used to monitor data center conditions

5-2 Alarms vs Alerts and Normal vs Abnormal Conditions

- Distinguish alarms from alerts in a monitoring context
- Recognize the difference between normal and abnormal conditions
- Understand why clear escalation and prioritization matter during abnormal conditions

5-3 Trend Data and Basic Control Loops and Escalation Basics

- Understand what trend data is and why it matters in monitoring
- Understand a basic control loop at a conceptual level (what it does, not how to tune it)
- Use structured escalation thinking when a trend shows abnormal conditions

Section 6 - Operating Procedures & Reliability Culture

6-1 SOPs and EOPs in Data Center Operations

- Understand why procedures are followed exactly in data center operations
- Understand the difference between SOPs and EOPs
- Identify what good procedure discipline looks like during routine work and abnormal conditions

6-2 Maintenance, Operations and Change Management

- Understand the difference between maintenance and operations in a data center context
- Understand why change management exists and what it tries to prevent
- Identify safe, structured communication and escalation behaviors during planned changes

6-3 Human Performance Fundamentals

- Understand why human performance affects safety and reliability in data center operations
- Define situational awareness, peer checks, and complacency risk in an operations context
- Identify practical behaviors that reduce human error during routine work and abnormal conditions

Section 7 - Tools, Documentation & Technical Literacy

7-1 Work Orders and Maintenance Logs

- Understand why documentation is required in data center operations
- Define work orders and maintenance logs and explain how they are used
- Identify what “good” recordkeeping looks like for reliability and safe escalation

7-2 Shift Handover Notes and Communication Standards

- Understand why shift handovers must be clear and consistent
- Define shift handover notes and identify what “good” handover content includes
- Use a simple communication standard to report status and escalation items

7-3 Basic Tool Identification and Multimeter Awareness

- Identify common tools used during rounds and checks
- Understand multimeter awareness, including what it measures and when to use it
- Describe safe, professional expectations for using tools under procedure
- Recognize basic hand tools and documentation tools used in data center work

Section 8 - Career Readiness & Entry-Level Transition

8-1 Entry-Level Role Expectations and Shift Schedules

- Understand entry-level Critical Facilities Technician (CFT) job expectations
- Understand common shift schedule realities in data center operations
- Identify professional communication behaviors that support safe, reliable operations

8-2 Interviews and Professional Communication

- Prepare for interviews for entry-level Critical Facilities roles
- Answer safety-based interview questions using clear structure
- Demonstrate professional communication during interview scenarios
- Identify what “good” resume content looks like for entry-level candidates