

# uCertify

## Course Outline

### Cyber-Security for Smart Grid Control



16 May 2026

1. Exercises, Quizzes, Flashcards & Glossary

Number of Questions

2. Expert Instructor-Led Training

3. ADA Compliant & JAWS Compatible Platform

4. State of the Art Educator Tools

5. Award Winning Learning Platform (LMS)

6. Chapter & Lessons

Syllabus

Chapter 1: Preface

Chapter 2: Smart Grid Cyber-Physical System: An Overview

Chapter 3: Smart Grid Control

Chapter 4: Attack Modeling for Smart Grid Control

Chapter 5: Vulnerability Assessment for Multi-area Load Frequency Control

Chapter 6: MITRE ATT&CK for Smart Grid Cyber-Security

Chapter 7: Signal Processing-Based Attack Detection

Chapter 8: Machine Learning-Based Attack Detection

Chapter 9: Attack Mitigation and Recovery in Smart Grid Control

Chapter 10: Appendix A: Test Systems Data

Chapter 11: Appendix B: Detailed Equations for Cascading Outage Model

Chapter 12: Appendix C: Information Theory and Hypothesis Testing

Chapter 13: Appendix D: Proofs of Theorems

Videos and How To

7. Live labs

Lab Tasks

Here's what you get

1.  Exercises

There is no limit to the number of times learners can attempt these. Exercises come with detailed remediation, which ensures that learners are confident on the topic before proceeding.

**50**  
EXERCISES

## 2. Quiz

Quizzes test your knowledge on the topics of the exam when you go through the course material. There is no limit to the number of times you can attempt it.

**96**  
QUIZ

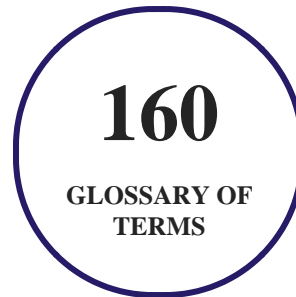
## 3. flashcards

Flashcards are effective memory-aiding tools that help you learn complex topics easily. The flashcard will help you in memorizing definitions, terminologies, key concepts, and more. There is no limit to the number of times learners can attempt these. Flashcards help master the key concepts.

**160**  
FLASHCARDS

## 4. Glossary of terms

uCertify provides detailed explanations of concepts relevant to the course through Glossary. It contains a list of frequently used terminologies along with its detailed explanation. Glossary defines the key terms.



## 5. Expert Instructor-Led Training

uCertify uses the content from the finest publishers and only the IT industry's finest instructors. They have a minimum of 15 years real-world experience and are subject matter experts in their fields. Unlike a live class, you can study at your own pace. This creates a personal learning experience and gives you all the benefit of hands-on training with the flexibility of doing it around your schedule 24/7.

## 6. ADA Compliant & JAWS Compatible Platform

uCertify course and labs are ADA (Americans with Disability Act) compliant. It is now more accessible to students with features such as:

- Change the font, size, and color of the content of the course
- Text-to-speech, reads the text into spoken words
- Interactive videos, how-tos videos come with transcripts and voice-over
- Interactive transcripts, each word is clickable. Students can clip a specific part of the video by clicking on a word or a portion of the text.

JAWS (Job Access with Speech) is a computer screen reader program for Microsoft Windows that reads the screen either with a text-to-speech output or by a Refreshable Braille display. Student can easily navigate uCertify course using JAWS shortcut keys.

## 7. State of the Art Educator Tools

uCertify knows the importance of instructors and provide tools to help them do their job effectively. Instructors are able to clone and customize course. Do ability grouping. Create sections. Design grade scale and grade formula. Create and schedule assessments. Educators can also move a student from self-paced to mentor-guided to instructor-led mode in three clicks.

## 8. Award Winning Learning Platform (LMS)

uCertify has developed an award winning, highly interactive yet simple to use platform. The SIIA CODiE Awards is the only peer-reviewed program to showcase business and education technology's finest products and services. Since 1986, thousands of products, services and solutions have been recognized for achieving excellence. uCertify has won CODiE awards consecutively for last 7 years:

- **2014**

1. Best Postsecondary Learning Solution

- **2015**

1. Best Education Solution
2. Best Virtual Learning Solution
3. Best Student Assessment Solution
4. Best Postsecondary Learning Solution
5. Best Career and Workforce Readiness Solution
6. Best Instructional Solution in Other Curriculum Areas
7. Best Corporate Learning/Workforce Development Solution

- **2016**

1. Best Virtual Learning Solution
2. Best Education Cloud-based Solution
3. Best College and Career Readiness Solution
4. Best Corporate / Workforce Learning Solution
5. Best Postsecondary Learning Content Solution

6. Best Postsecondary LMS or Learning Platform
7. Best Learning Relationship Management Solution

- **2017**

1. Best Overall Education Solution
2. Best Student Assessment Solution
3. Best Corporate/Workforce Learning Solution
4. Best Higher Education LMS or Learning Platform

- **2018**

1. Best Higher Education LMS or Learning Platform
2. Best Instructional Solution in Other Curriculum Areas
3. Best Learning Relationship Management Solution

- **2019**

1. Best Virtual Learning Solution
2. Best Content Authoring Development or Curation Solution
3. Best Higher Education Learning Management Solution (LMS)

- **2020**

1. Best College and Career Readiness Solution
2. Best Cross-Curricular Solution
3. Best Virtual Learning Solution

## 9. Chapter & Lessons

uCertify brings these textbooks to life. It is full of interactive activities that keeps the learner engaged. uCertify brings all available learning resources for a topic in one place so that the learner can efficiently learn without going to multiple places. Challenge questions are also embedded in the chapters so learners can attempt those while they are learning about that particular topic. This helps them grasp the concepts better because they can go over it again right away which improves learning.

Learners can do Flashcards, Exercises, Quizzes and Labs related to each chapter. At the end of every lesson, uCertify courses guide the learners on the path they should follow.

# Syllabus

## Chapter 1: Preface

- Nomenclature

## Chapter 2: Smart Grid Cyber-Physical System: An Overview

- Introduction
- Smart Grid Cyber-Physical System
- Issues in Smart Grid Cyber-Physical Systems
- Attacks on Smart Grid Systems
- Defense in Depth Security Approach
- Cyber-Security in Smart Grid Control

## Chapter 3: Smart Grid Control

- Introduction
- Smart Grid Control and Cyber-Security
- Frequency Control
- Load Frequency Control Modeling
- State-Space Representations

- Load Frequency Control Cyber-Physical System
- Summary

## Chapter 4: Attack Modeling for Smart Grid Control

- Introduction
- Smart Grid Attack Modeling Overview
- Multi-area Load Frequency Control (MA-LFC)
- Attack Modeling for MA-LFC
- Stealth/Undetectable Attacks
- Multiple-Attack Model
- Attack Impact Analysis for IEEE 39-Bus New England Test System LFC
- Future Scope
- Summary

## Chapter 5: Vulnerability Assessment for Multi-area Load Frequency Control

- Introduction
- Data Penetration Testing
- Cascading Outage Model

- Vulnerability Assessment
- Detailed Risk Quantification Methodology
- Case Study: Vulnerability Assessment for 9-Bus and 39-Bus New England Systems
- Summary

## Chapter 6: MITRE ATT&CK for Smart Grid Cyber-Security

- Introduction
- Understanding MITRE ATT&CK
- Mapping Threats to Smart Grids
- Using MITRE ATT&CK for Smart Grid Defense
- MITRE ATT&CK for Vulnerability Assessment and Penetration Testing (VAPT)
- Analyze the Likelihood, Impact, and Risk Scores
- Case Study: MITRE ATT&CK for Substation VA
- Summary

## Chapter 7: Signal Processing-Based Attack Detection

- Introduction
- Multi-level Attack Detection
- Singular Spectral Analysis (SSA)-Based Attack Detection

- Process Level Single Variate Attack Detection
- Multivariate SSA for Control Center Level Detection
- Performance Analysis of Detection Algorithm
- Multi-level Attack Detection Results
- Hypothesis Testing-Based Attack Detection
- SSA Hoeffding Test-Based Hypothesis Testing
- Adaptive Threshold Selection
- Adaptive Attack Detection Results
- Summary

## Chapter 8: Machine Learning-Based Attack Detection

- Introduction
- Machine Learning in Smart Grid Attack Detection
- Support Vector Data Description Based Online Attack Detection
- Simulation Results and Discussions
- Summary

## Chapter 9: Attack Mitigation and Recovery in Smart Grid Control

- Introduction
- Attack Mitigation in Smart Grids
- Adaptive Control-Based Attack Mitigation
- Attack Mitigation for 39-Bus 3 Area System
- IoT-Based Hardware Model
- Research Scope
- Summary

## Chapter 10: Appendix A: Test Systems Data

- A.1 IEEE 9-Bus System
- A.2 39-Bus New England Test System
- A.3 IEEE 300-Bus System

## Chapter 11: Appendix B: Detailed Equations for Cascading Outage Model

## Chapter 12: Appendix C: Information Theory and Hypothesis Testing

- C.1 Hoeffding Test
- C.2 Neyman-Pearson Theorem

## Chapter 13: Appendix D: Proofs of Theorems

- D.1 Theorem 3.1
- D.2 Theorem 6.1
- D.3 Theorem 6.2

## 10. Live Labs

The benefits of live-labs are:

- Exam based practical tasks
- Real equipment, absolutely no simulations
- Access to the latest industry technologies
- Available anytime, anywhere on any device
- Break and Reset functionality
- No hardware costs

## Lab Tasks

### **Smart Grid Cyber-Physical System: An Overview**

- Implementing an IDS
- Configuring Router ACLs for DMZ-like Traffic Control

### **Smart Grid Control**

- Simulating a Basic LFC Model

### **Attack Modeling for Smart Grid Control**

- Simulating a DDoS Attack
- Simulating a DoS Attack
- Simulating a MA-LFC Model
- Performing Attack Impact Analysis on the 39-Bus System Using LFC

### **Vulnerability Assessment for Multi-area Load Frequency Control**

- Performing VA on a 9-Bus System
- Performing VA on the 39-Bus New England System

### **MITRE ATT&CK for Smart Grid Cyber-Security**

- Examining MITRE ATT&CK
- Conducting Red-Teaming Exercises Using MITRE ATT&CK Tactics and Techniques

### **Signal Processing-Based Attack Detection**

- Performing an MITM Attack
- Defending Against IP Spoofing
- Performing MSSA-Based Cyber-Attack Detection for a Multi-Area LFC System
- Implementing Multi-Level Attack Detection Using SSA and MSSA in Power Systems
- Implementing Adaptive MSSA-Based Attack Detection in MAPS

### **Machine Learning-Based Attack Detection**

- Performing SVDD-based Attack Detection

### **Attack Mitigation and Recovery in Smart Grid Control**

- Implementing Attack-Resilient LFC on a 39-Bus 3-Area System

**Here's what you get**

**18**

LIVE LABS

**18**

VIDEO TUTORIALS

**01:09**

HOURS

**You can't stay away! Get**

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