WBFAA Apprentice Program

NEW REVISED February 2024 Syllabus

First Semester
14 WEEKS 84 HOURS
Midterm and Final Exam = 16 in class LAB HOURS
10 Webinars @ one hour = 10 HOURS

S1W1 MANDATORY ONLINE ORIENTATION – Completed in student transcript.

S1W1 – Business Communication Skills

Module 00107

- 1.0.0 Introduction
- 1.1.0 The Communications Process
- 1.1.1 Nonverbal Communication
- 1.1.2 Listening and Speaking Skills
- 1.2.0 Active Listening on the Job
- 1.2.1 Barriers to Listening
- 1.3.0 Speaking on the Job
- 1.3.1 Placing Telephone Calls
- 1.3.2 Receiving Telephone Calls
- 2.0.0 Reading and Writing Skills
- 2.1.0 The Importance of Reading and Writing Skills
- 2.2.0 Reading on the Job
- 2.3.0 Writing on the Job
- 2.3.1 Emails
- 2.3.2 Texting

WEBINAR S1W1 Intro to NFPA, CFC, NEC,CEC

S1W2 – Basic Employability Skills

Module 00108-09

- 1.0.0 Opportunities in the Construction Industry
- 1.1.0 The Construction Business
- 1.2.0 Entering the Construction Workforce
- 2.0.0 Critical Thinking and Problem Solving
- 2.1.0 Critical Thinking and Barriers
- 2.1.1 Barriers to Problem Solving
- 2.2.0 Solving Problems Using Critical Thinking
- 2.2.1 Defining the Problem
- 2.2.2 Analyzing the Alternatives

2.2.3 Choose a Solution and Plan
2.2.4 Implement and Monitor
2.2.5 Evaluate the Final Result
2.3.0 Planning and Scheduling Problems
2.3.1 Materials
2.3.2 Equipment
2.3.3 Tools
2.3.4 Labor
2.3.5 Handling Delays
3.0.0 Relationship and Social Skills
3.1.0 Personal and Social Skills
3.1.1 Personal Habits
3.1.2 Work Ethic
3.1.3 Tardiness and Absenteeism
3.2.0 Conflict Resolution
3.2.1 Resolving Conflicts with Co-Workers
3.2.2 Resolving Conflicts with Supervisors
3.3.0 Giving and Receiving Criticism
3.3.1 Offering Constructive Criticism
3.3.2 Receiving Constructive Criticism
3.3.3 Destructive Criticism
3.4.0 Social Issues in the Workplace
3.4.1 Harassment
3.4.2 Drug and Alcohol Abuse
3.5.0 Teamwork and Leadership
3.5.1 Leadership Skills

WEBINAR S1W2 NFPA 72 2019 - Chapter 1 Maneuvering code/Terminology

S1W3 – Basic Safety Part I
Module 00101
1.0.0 Safety and Hazard Recognition
1.1.0 Incidents and Accidents
1.1.1 Incident and Accident Categories
1.1.2 Costs
1.2.0 Incident and Accident Causes
1.2.1 Failure to Communicate
1.2.2 At-Risk Work Habits
1.2.3 Alcohol and Drug Abuse
1.2.4 Lack of Skill
1.2.5 Intentional Acts
1.2.6 Unsafe Acts
1.2.7 Rationalizing Risk
1.2.8 Unsafe Conditions
1.2.9 Poor Housekeeping
1.2.10 Management System Failure

1.3.0 Hazard Recognition, Evaluation, and Control
1.3.1 Hazard Recognition
1.3.2 Job Safety Analysis (JSA) and Task Safety Analysis (TSA)
1.3.3 Risk Assessment
1.3.4 Reporting Injuries, Incidents, and Near-Misses
1.3.5 Safety Data Sheets
2.0.0 Elevated Work and Fall Protection
2.1.0 Fall Types and Hazards
2.1.1 Walking and Working Surfaces
2.1.2 Unprotected Sides, Wall Openings, and Floor Holes
2.2.0 Fall Arrest
2.2.1 Anchor Points
2.2.2 Harnesses
2.2.3 PFAS Inspection
2.2.4 Lanyards
2.2.5 Lifelines
2.2.6 Guardrails
2.2.7 Safety Nets
2.3.0 Ladders and Stairs
2.3.1 Straight Ladders
2.3.2 Extension Ladders
2.3.3 Stepladders
2.3.4 Inspecting Ladders
2.3.5 Stairways

WEBINAR S1W3 NFPA 72 2019 - Chapter 3 Terminology

S1W4 – Basic Safety Part II
Module 00101
2.4.0 Scaffolds
2.4.1 Types of Scaffolds
2.4.2 Inspecting Scaffolds
2.4.3 Using Scaffolds
3.0.0 Struck-By and Caught-in-Between Hazards
3.1.0 Struck-By Hazards
3.1.1 Falling Objects
3.1.2 Flying Objects
3.1.3 Vehicle and Roadway Hazards
3.2.0 Caught-In and Caught-Between Hazards
3.2.1 Trenches and Excavations
3.2.2 Tool, Machine, and Equipment Guards
3.2.3 Cranes and Heavy Equipment
4.0.0 Energy Release Hazards
4.1.0 Electrical Safety Guidelines
4.1.1 Grounding
4.1.2 Ground Fault Circuit Interrupters

6.5.0 Confined Spaces

WEBINAR S1W4 NFPA 72 2019 Chapter 10 - 10.6.1 Fundamentals

S1W5 – **Basic Math Part I**
Module 00102 Introduction to Construction Math
1.0.0 Whole Numbers
1.1.0 Place Values of Whole Numbers
1.1.1 Study Problems: Place Values of Whole Numbers
1.2.0 Adding and Subtracting Whole Numbers
1.2.1 Study Problems: Adding and Subtracting Whole Numbers
1.3.0 Multiplying and Dividing Whole Numbers
1.3.1 The Order of Operations
1.3.2 Study Problems: Multiplying and Dividing Whole Numbers
2.0.0 Fractions
2.1.0 Equivalent Fractions and Lowest Common Denominators
2.1.1 Finding Equivalent Fractions
2.1.2 Reducing Fractions to Their Lowest Terms
2.1.3 Comparing Fractions and Finding Lowest Common Denominators
2.1.4 Study Problems: Finding Equivalent Fractions
2.2.0 Improper Fractions and Mixed Numbers
2.2.1 Study Problems: Changing Improper Fractions to Mixed Numbers
2.3.0 Adding and Subtracting Fractions
2.3.1 Study Problems: Adding and Subtracting Fractions
2.4.0 Multiplying and Dividing Fractions
2.4.1 Study Problems: Multiplying and Dividing Fractions

WEBINAR S1W5 NFPA 2019 Chapter 10 - 10.6.1 Fundamentals

S1W6 – **Basic Math Part II**
Module 00102 Introduction to Construction Math
3.0.0 The Decimal System
3.1.0 Decimals
3.1.1 Rounding Decimals
3.1.2 Comparing Decimals with Decimals
3.1.3 Study Problems: Working with Decimals
3.2.0 Adding, Subtracting, Multiplying, and Dividing Decimals
3.2.1 Adding and Subtracting Decimals
3.2.2 Multiplying Decimals
3.2.3 Dividing with Decimals
3.2.4 Using the Calculator to Add, Subtract, Multiply, and Divide Decimals
3.2.5 Study Problems: Decimals
3.3.0 Converting Decimals, Fractions, and Percentages
3.3.1 Converting Decimals to Percentages and Percentages to Decimals

3.3.2 Converting Fractions to Decimals
3.3.3 Converting Decimals to Fractions
3.3.4 Converting Inches to Decimal Equivalents in Feet
3.3.5 Study Problems: Converting Different Values
3.3.6 Practical Applications
4.0.0 Measuring Length
4.1.0 Reading English and Metric Rulers
4.1.1 The English Ruler
4.1.2 The Metric Ruler
4.1.3 Study Problems: Reading Rulers
4.2.0 The Measuring Tape
4.2.1 The English Measuring Tape
4.2.2 The Metric Measuring Tape
4.2.3 Using a Tape Measure
4.2.4 Study Problems: Reading Measuring Tapes
5.0.0 Metric and Inch-Pound Measurement Systems
5.1.0 Units of Length Measurement
5.1.1 Inch-Pound System Units of Length
5.1.2 Metric System Units of Length
5.1.3 Converting Length Units Between Systems
5.1.4 Study Problems: Converting Measurements
5.2.0 Units of Weight Measurement
5.2.1 Inch-Pound Units of Weight
5.2.2 Metric Units of Weight
5.2.3 Converting Weight Units Between Systems
5.2.4 Study Problems: Converting Weight Units
5.3.0 Units of Volume Measurement
5.3.1 Inch-Pound Units of Volume
5.3.2 Metric Units of Volume
5.3.3 Converting Volume Units Between Systems
5.3.4 Study Problems: Converting Volume Units
5.4.0 Temperature Units
5.4.1 Study Problems: Converting Temperatures

WEBINAR S1W6 NFPA 2019 Chapter 12 Circuits and Pathways

S1W7 – Basic Math Part III
Module 00102 Introduction to Construction Math
6.0.0 Introduction to Geometry
6.1.0 Angles
6.2.0 Shapes
6.2.1 Rectangle
6.2.2 Square
6.2.3 Triangle
6.2.4 Circle
6.3.0 Calculating the Area of Shapes

6.3.1 Study Problems: Calculating Area
6.4.0 Volume of Three-Dimensional Shapes
6.4.1 Three-Dimensional Rectangles
6.4.2 Cubes
6.4.3 Cylinders
6.4.4 Triangular Prisms
6.4.5 Study Problems: Calculating Volume
6.4.6 Practical Applications Using Volume

Midterm Lab Schedule – No Live Webinar Scheduled for Week of Midterm

1. CPR Certification (Lab)
2. Material Handling (Module 00109; Sections 1.1.0, 1.1.3)
3. Elevated Work and Fall Protection (Module 00101; Sections 2.0.0, 2.3.1, 2.3.2, 2.3.3 (Section 2.3.4, Lab)
4. Fire Hazards and Fire Fighting (Module 00101; Section 6.4.0, 6.4.1, 6.4.2, 6.4.3, 6.4.4)
5. Use of Fire Extinguisher (Module 00101; Section 6.4.5, Lab)
6. Midterm Review (Modules 00101, 00102, 00107, 00108, 00109)
7. Midterm Exam

What to bring:

1. Notepad
2. Pens or pencils
3. Electronic Systems Technician: Core Curriculum Textbook Edition 6

S1W8 – Intro to Hand Tools Part I

Module 00103 Introduction to Hand Tools

1.0.0 Common Hand Tools
1.1.0 Hammers and Demolition Tools
1.1.1 Claw Hammers
1.1.2 Drywall Hammer
1.1.3 Ball Peen Hammer
1.1.4 Sledgehammers
1.1.5 Nail Pullers
1.1.6 Safety and Maintenance
1.2.0 Chisels and Punches
1.2.1 Chisels
1.2.2 Punches
1.2.3 Safety and Maintenance
1.3.0 Screwdrivers
1.3.1 Safety and Maintenance
1.4.0 Wrenches
1.4.1 Non-Adjustable Wrenches
1.4.2 Adjustable Wrenches
1.4.3 Socket Wrenches
1.4.4 Safety and Maintenance

1.5.0 Pliers and Wire Cutters
1.5.1 Slip-Joint Pliers
1.5.2 Long-Nose Pliers
1.5.3 Lineman's Pliers
1.5.4 Tongue-and-Groove Pliers
1.5.5 Locking Pliers
1.5.6 Safety and Maintenance
2.0.0 Measurement and Layout Tools
2.1.0 Rules and Other Measuring Tools
2.1.1 Steel Rule
2.1.2 Tape Measure
2.1.3 Wooden Folding Rule
2.1.4 Laser Measuring Tools
2.1.5 Safety and Maintenance
2.2.0 Levels and Layout Tools
2.2.1 Spirit Levels
2.2.2 Digital Levels
2.2.3 Laser Levels
2.2.4 Level Safety and Maintenance

WEBINAR S1W7 NFPA 2019 Chapter 12 Circuits and Pathways

S1W9 – Intro to Hand Tools Part II
Module 00103 Introduction to Hand Tools
2.2.5 Squares
2.2.6 Use and Maintenance
2.2.7 Plumb Bob
2.2.8 Chalk Lines
3.0.0 Other Common Hand Tools
3.1.0 Saws
3.1.1 Handsaws
3.1.2 Safety and Maintenance
3.2.0 Clamps
3.2.1 Safety and Maintenance
3.3.0 Files and Utility Knives
3.3.1 Files and Rasps
3.3.2 Utility Knives
3.3.3 Safety and Maintenance
3.4.0 Shovels and Picks
3.4.1 Safety and Maintenance

WEBINAR S1W8 NFPA 2019 Chapter 12 Circuits and Pathways

S1W10 – Basic Rigging Part I
Module 00106 Introduction to Basic Rigging

1.0.0 Basic Rigging Equipment
1.1.0 Slings
1.1.1 Sling Tagging Requirements
1.1.2 Synthetic Slings
1.1.3 Alloy Steel Chain Slings
1.1.4 Wire Rope Slings
1.2.0 Sling Inspection
1.2.1 Synthetic Sling Inspection
1.2.2 Alloy Steel Chain Sling Inspection
1.2.3 Wire Rope Sling Inspection
1.3.0 Rigging Hardware
1.3.1 Shackles
1.3.2 Eyebolts
1.3.3 Lifting Clamps
1.3.4 Rigging Hooks

WEBINAR S1W9 NFPA 2019 Chapter 12 Circuits and Pathways

S1W11 – Basic Rigging Part II
Module 00106 Introduction to Basic Rigging

1.4.0 Hoists
1.4.1 Operation of Chain Hoists
1.4.2 Hoist Safety and Maintenance
1.5.0 Hitches
1.5.1 Vertical Hitch
1.5.2 Choker Hitch
1.5.3 Basket Hitch
1.5.4 The Emergency Stop Signal

WEBINAR S1W10 Review Semester 1 Webinars

S1W12 –Intro to Construction Drawings Part I
Module 00105

1.0.0 Construction Drawings and Their Components
1.1.0 Basic Components of Construction Drawings
1.1.1 Title Block
1.1.2 Border
1.1.3 Drawing Area
1.1.4 Revision Block
1.1.5 Legend
1.1.6 North Arrow

S1W13 – Intro to Construction Drawings Part II
Module 00105

1.5.0 Six Types of Construction Drawings
1.5.1 Civil Plans
1.5.2 Architectural Plans
1.5.3 Structural Plans
1.5.4 Mechanical Plans
1.5.5 Plumbing/Piping Plans
1.5.6 Electrical Plans
1.5.7 Other Drawings and Documents
1.4.0 Measuring Scales
1.4.1 Architect's Scale
1.4.2 Metric Scale (Metric Architect's Scale)
1.4.3 Engineer's Scale
1.2.0 Drawing Elements
1.2.1 Lines of Construction
1.2.2 Abbreviations, Symbols, and Keynotes
1.2.3 Using Gridlines to Identify Plan Locations

S1W14 – Introduction to Power Tools
Module 00104
1.0.0 Power Drills/Drivers
1.1.0 Basic Power Tool Safety Guidelines
1.1.1 Types of Power Drills/Drivers
1.2.1 Power Drills and Bits
1.2.1 Cordless Tools and Batteries
1.2.3 Power Drill Safety and Maintenance Guidelines
1.2.4 Preparing to Use a Power Drill
Preparing Drills with Keyed Chucks
Preparing Drills with Keyless Chucks
1.2.5 Operating Power Drills
1.2.6 Electromagnetic Drill Presses
1.3.0 Hammer Drills and Impact Drivers
1.3.1 Hammer Drill Safety and Maintenance
1.3.2 Operating Hammer Drills
1.3.3 Impact Drivers
1.3.4 Impact Driver Safety and Maintenance
1.3.5 Operating Impact Drivers
1.4.0 Pneumatic Drills and Impact Wrenches
1.4.1 Pneumatic Drills
1.4.2 Impact Wrenches
1.4.3 Pneumatic Tool Safety and Maintenance Guidelines
1.4.4 Operating Pneumatic Drills and Impact Wrenches
2.0.0 Power Saws

2.1.0 Circular Saws
2.1.1 Circular Saw Safety Guidelines and Maintenance
2.1.2 Operating Circular Saws
2.2.0 Jigsaws and Reciprocating Saws
2.2.1 Jigsaws
2.2.2 Reciprocating Saws
2.2.3 Jigsaw and Reciprocating Saw Safety and Maintenance
2.2.4 Operating Jigsaws and Reciprocating Saws
2.3.0 Portable Band Saws
2.3.1 Band Saw Safety and Maintenance
2.3.2 Operating a Portable Band Saw
2.4.0 Miter and Cutoff Saws
2.4.1 Power Miter Saws
2.4.2 Abrasive Cutoff Saws
2.4.3 Miter and Cutoff Saw Safety and Maintenance
2.4.4 Operating Miter and Cutoff Saws
2.5.0 Table Saws
2.5.1 Table Saw Safety and Maintenance
2.5.2 Ripping Wood with a Table Saw
3.0.0 Grinders and Oscillating Multi-Tools
3.1.0 Grinders
3.1.1 Grinder Safety and Maintenance
For Angle, End, and Detail Grinders
For Bench Grinders
3.1.2 Operating Grinders
For Angle, End, and Detail Grinders
For Bench Grinders
3.2.0 Grinder Attachments and Accessories
3.3.0 Oscillating Multi-Tools
3.3.1 Oscillating Multi-Tool Safety and Maintenance
4.0.0 Miscellaneous Power Tools
4.1.0 Power Nailers
4.1.1 Power Nailer Safety and Maintenance
4.1.2 Operating Power Nailers
4.2.0 Hydraulic Jacks
4.2.1 Hydraulic Jack Safety and Maintenance

WEBINAR S1W14 No Class. Final and Lab.

Final Lab Schedule

1. Introduction to Construction Drawings (Module 00105, Sections 1.0.0, 1.1.0, 1.2.0) (Section 1.5.0, Lab)
2. Working with Measurements (Module 00102; Sections 4.0.0, 4.1.0, 4.2.0)

3. Scale (Module 00105; Sections 1.3.0, 1.4.0, Lab)
4. Final Exam Review (Modules 00103, 00104, 00105, 00106)
5. Final Exam

What to Bring:

1. Notepad
2. Pens or pencils
3. Core Curriculum Textbook Edition 6

Second Semester
12 WEEKS 72 HOURS
Midterm and Final Exam = 16 in class LAB HOURS
8 Webinars @ one hour = 8 hours

S2W1 – Introduction to the Trade
New Module 33101-10

1.0.0 Introduction
1.2.0 Electronic Systems Opportunities
1.3.0 Integrated Systems
2.0.0 Certification and Licensing
3.0.0 Professional Responsibilities
4.0.0 Standards and Building Codes
5.0.0 Documentation
6.0.0 Training
7.0.0 Tools and Methods

WEBINAR S2W1 Introduction to NFPA 70/Article 760 - General Definitions and Articles

S2W2 – Wood and Masonry Construction Methods
Module 33102-10

1.0.0 Introduction
2.0.0 Building Materials
2.1.0 Gypsum Board
2.2.0 Masonry Materials
2.2.1 Concrete Masonry Units
2.2.2 Brick
2.2.3 Stone
3.0.0 Wood Frame Construction
3.1.0 Floor Construction
3.1.1 Girders
3.1.2 Floor Joists
3.1.3 Wood I-Beams
3.1.4 Trusses
3.1.7 Subflooring

3.2.0 Wall Construction
3.2.4 Firestops
3.3.0 Ceiling Construction
3.4.0 Roof Construction
3.4.1 Roof Components
3.4.4 Dormers
3.5.0 Post-and-Beam Framing
4.0.0 3.6.0 Wall Framing in Masonry Fasteners and Anchors
4.1.0 Screws
4.1.1 Wood Screws
4.1.3 Concrete/Masonry Screws
4.1.6 Drywall Screws
4.2.0 Nonthreaded Fasteners
4.3.0 Screw Anchors
4.4.0 Hollow Wall Anchors
5.0.0 Tools Used for Running Cable
5.1.0 Guidelines for Using Power Tools
5.1.1 Safety Rules for All Power Tools
5.2.0 Drilling Tools
5.3.0 Cutting Tools

WEBINAR S2W2 NEC Article 760 Execution of Work

S2W3 – Concrete and Steel Construction Methods
Module 33103-10

1.0.0 Introduction
2.0.0 Building Materials
2.1.0 Concrete
2.2.0 Metal
3.0.0 Commercial Construction Methods
3.1.0 Floors
3.2.0 Walls
3.4.0 Roof Structure
3.5.0 Ceilings
4.0.0 Fire-Rated and Sound-Rated Walls
5.0.0 Fasteners and Anchors
5.2.0 Bolt and Screw Types
5.5.0 Installing Fasteners
5.10.0 Guidelines for Drilling Anchor5 Holders
6.0.0 Special Tools
7.0.0 Project Schedules

WEBINAR S2W3 NEC Article 760 Cabling

S2W4 – Pathways and Spaces Part I

Module 33104-10

1.0.0 Introduction
2.0.0 Raceways
3.0.0 Conduit
3.1.0 Conduit as a Ground Path
3.2.0 Electrical Nonmetallic Tubing
3.4.0 Electrical Metallic Tubing
3.5.0 Rigid Metal Conduit
3.90 Intermediate Metal Conduit
3.10.0 Rigid Nonmetallic Conduit
3.10.4 Liquidtight Flexible Nonmetallic Conduit
3.11.0 Flexible Metal Conduit
4.0.0 Metal Conduit Fittings
4.1.0 Couplings
4.2.0 Conduit Bodies
4.2.5 Threaded Weatherproof Hubs
4.3.0 Insulating Bushings
4.4.0 Offset Nipples
13.0.0 Boxes
13.1.0 Metal Boxes
13.1.1 Pryouts
13.1.2 Knockouts
13.2.0 Nonmetallic Boxes
13.3.0 Low Voltage Boxes
6.0.0 Sealing Fittings
7.0.0 Cable and Raceway Supports
7.1.0 Straps
7.2.0 Standoff Supports
7.5.1 Cable Ties
7.5.2 Cable Hangers
8.0.0 Surface Metal and Nonmetallic Raceways

WEBINAR S2W4 NFPA 70 Chapter 3

S2W5 – Pathways and Spaces Part II
Module 33104-10
9.0.0 Cable Trays
9.2.0 Cable Tray Supports
10.0.0 Storing Raceways
12.0.0 Underground Systems
12.1.0 Duct Materials
12.4.0 Controlled Environment Vaults
13.0.0 Boxes
14.0.0 Making a Rigid Conduit-to-Box Connection
15.5.0 Suspended Ceilings

16.1.0 Pathways
16.2.0 Spaces

Semester 2 Midterm Lab

1. Commercial Building Tour
2. Drill use and bit selection
3. Power cutting tools
4. Lab: Cable identification
5. Lab: Pulling cables
6. Lab: Drilling and fishing cables
7. Lab: Joining PVC
8. Midterm Review
9. Midterm Exam

What to bring:

1. Notepad
2. Pens or pencils
3. WBFAA Semester 2 Digital or physical textbook.

S2W6 – Hand Bending of Conduit

Module 33106-10

1.0.0 Introduction
2.0.0 Cutting, Reaming, and Threading Conduit
2.1.0 Cutting Conduit with a Hacksaw
2.2.0 Cutting Conduit with a Pipe Cutter
2.3.0 Reaming Conduit
2.4.0 Threading Conduit
2.5.0 Cutting and Joining PVC Conduit
3.0.0 Hand Bending Equipment
3.1.0 Geometry Required to Make a Bend
3.2.0 Making a 90-Degree Bend
3.3.0 Gain
3.4.0 Back-to-Back 90-Degree Bends
3.5.0 Offsets
3.6.0 Parallel Offsets
3.7.0 Saddle Bends
3.8.0 Four-Bend Saddles

WEBINAR S2W5 NEC Article 300 Wiring Methods

S2W7 – Pull and Junction Boxes

Module 26205-20

1.0.0 Boxes and Fittings
1.1.0 Pull and Junction Boxes
1.1.1 Boxes for Damp and Wet Locations
1.1.2 NEMA and IP Enclosure Classifications

1.2.0 Fittings
1.2.1 EMT Fittings.
1.2.2 Rigid, Aluminum, and IMC Fittings
1.2.3 Locknuts and Bushings
2.0.0 Sizing Pull and Junction Boxes
2.1.0 Sizing Pull and Junction Boxes for Systems Under 1,000V
2.2.0 Sizing Pull and Junction Boxes for Systems Over 1,000V
3.0.0 Specialty Enclosures
3.1.0 Conduit Bodies and Other Cast Enclosures
3.1.1 Type C Conduit Bodies
3.1.2 Type L Conduit Bodies
3.1.3 Type T Conduit Bodies
3.1.4 Type X Conduit Bodies
3.1.5 FS and FD Boxes
3.1.6 Pulling Elbows
3.1.7 Entrance Ells (SLBs)
3.1.8 Moguls
3.2.0 Handholes
3.2.1 Handhole Construction
3.2.2 ANSI/SCTE Requirements

WEBINAR S2W6 NEC Article 725 Class 1,2 and 3 circuits

S2W8 – Limited-Energy Cabling
Module 33108
1.0.0 Low-Voltage Cable Installation
1.1.0 Wire Sizes and Materials.
1.1.1 Sizes
1.1.2 Materials
1.2.0 NEC® Requirements for Low Voltage and Optical Fiber
1.2.1 Classifications and Ratings
1.2.2 Power-Limited Tray Cable Applications
1.3.0 Communication Cable Styles and Construction
1.3.1 Unshielded Twisted-Pair Cable (UTP)
1.3.2 UTP Patch Cords
1.3.3 Undercarpet Telecommunication Cable (UC
1.3.4 Foil and Shield
1.3.5 Coaxial Cable
1.3.6 Optical Fiber Cable
2.0.0 Commercial Cable Installation
2.1.0 Tools
2.1.1 Fish Tapes and Poles
2.1.2 Power Conduit Fishing Systems
2.1.3 Cable Grips
2.1.4 Pull Lines
2.1.5 Pulling Equipment

2.2.0 Planning the Installation
2.2.1 Preliminary Calculations
2.2.2 Determining the Pulling Location
2.2.3 Pathway Cable Pull Operations
2.3.0 Setup Prior to Pulling
2.3.1 Cable Reels or Boxes
2.3.2 Preparing Conduit Pathways
2.3.3 Installing a Pull Line in Conduit
2.3.4 Installing a Pull Line in Open Ceilings
2.3.5 Preparing Cable Ends
2.3.6 Pulling Lines and Setup
2.4.0 Vertical and Horizontal Pathway Cable Pulls
2.4.1 Vertical Backbone Cable Pulls from the Top Down
2.4.2 Vertical Backbone Cable Pulls from the Bottom Up
2.4.3 Horizontal Backbone Cable Pulls
2.4.4 Optical Fiber Backbone Cable Pulls
2.4.5 Horizontal Work Area Cable Pulls
2.4.6 Conduit Fill for Backbone Cable
3.0.0 Residential Low-Voltage Cable Installation
3.1.0 Residential Low-Voltage Systems
3.1.1 Understanding the Job
3.1.2 Residential Unit Communication/Data Cabling Requirements and Grades
3.1.3 Residential Cable Installation Requirements/Considerations
3.1.4 Drilling and Fishing Cable in Existing Construction
4.0.0 Interior Low-Voltage Cable Installation Requirements
4.1.0 NEC® Requirements for Circuits
4.1.1 Class 1 Circuits
4.1.2 Class 2 and 3 Circuits
4.1.3 Instrumentation Tray Cable Circuits
4.1.4 Nonpower-Limited Fire Alarm Circuits
4.1.5 Power-Limited Fire Alarm Circuits
4.1.6 Optical Fiber Circuits
4.1.7 Communication Circuits Within Buildings
4.1.8 Coaxial CATV Cable Installation Within Buildings
4.1.9 Network-Powered Broadband Communication System Installation Within Buildings
5.0.0 Telephone and Data Systems Cabling
5.1.0 Cabling Systems
5.1.1 Installation Standards
5.1.2 Outside Plant
5.1.3 Commercial Premises Wiring
5.1.4 Residential Premises Wiring
5.1.5 Grounding and Bonding
5.2.0 Electromagnetic Interference (EMI)
5.2.1 Reducing EMI

5.2.2 Precautions
5.2.3 EMI Guidelines

WEBINAR S2W7 NEC Article 770

S2W9 – Limited-Energy Cable Selection
Module 33208
1.0.0 Low-Voltage Cable Components
1.1.0 Cable Conductors and Insulation
1.1.1 Conductor Material
1.1.2 Insulation
2.0.0 Cable Selection
2.1.0 Key Criteria
2.1.1 Type of Installation
2.1.2 Length of Cable Run
2.1.3 Installation Techniques
2.2.0 Fire Alarm and Security System Cabling
2.2.1 Power-limited and Nonpower-Limited Circuits
2.3.0 Coaxial Cable
2.3.1 CCTV Applications
2.3.2 Cable and Satellite TV
2.4.0 Telecommunications and Data Cable
2.4.1 Unshielded Twisted-Pair Cable (UTP)
2.4.2 UTP Patch Cords
2.4.3 Optical Fiber Cable
3.0.0 Conductor Voltage Drop
3.1.0 Calculating Conductor Voltage Drop
3.1.1 Sequential Voltage Drop Method
3.1.2 Load Center Voltage Drop Method
3.1.3 End-Load Voltage Drop Method
3.1.4 Load Current Wire Selection Tables
3.1.5 Coaxial Cable Voltage Drop
4.0.0 Speaker Cable Power Drop
4.1.0 Calculating Power Loss
4.1.1 Direct-Coupled Speaker Systems
4.1.2 Distributed Constant-Voltage Speaker Systems
4.1.3 Distributed Amplifier/Direct-Coupled Speaker Systems

WEBINAR S2W8 Review

S2W10 – Limited-Energy Cable Termination
Module 33209
1.0.0 Coaxial Cable
1.1.0 Termination and Connectors
1.1.1 Preparing the Cable End
1.1.2 Applying a BNC Connector

1.1.3 Applying an F-Type Connector
1.1.4 Applying an RCA Connector
1.1.5 Coaxial Cable Testing
2.0.0 Terminating UTP and Optical Fiber Cable
2.1.0 UTP Cable Management
2.1.1 Check for Proper Cable Routing, Wiring Scheme, and Compatible Equipment
2.1.2 Form and Dress Cables at Consolidation Points or Cross-Connect Panels
2.1.3 Determine the Length and Slack Required for Cables
2.1.4 Using Proper Cable Management Hardware
2.2.0 Connectors and Equipment
2.2.1 Couplers/Modules
2.2.2 Consolidation Point or Cross-Connect Punchdown Blocks
2.2.3 Plugs, Patch Cords, and Workstation Equipment Cables
2.3.0 IDC Termination Blocks and Termination Procedures
2.3.1 Termination Tools
2.3.2 Type 66 Block Termination Procedures
2.3.3 Type 110 Block Termination Procedures
2.3.4 Workstation Coupler or Modular Jack Termination
2.3.5 Surface-Mount Box Termination Procedure
2.3.6 Modular Plug/Cord Fabrication and Termination Procedures
2.3.7 Patch Cord and 110 Block Plug Termination Procedures
2.3.8 Testing Twisted-Pair Cable
2.4.0 Optical Fiber Cable Connectors and Terminations
2.4.1 Common Components
3.0.0 Solderless Connections
3.1.0 Connector Types
3.1.1 Crimp Connectors for Screw Terminals
3.1.2 Splice-Type Crimp Connections
3.1.3 Wire Nuts
3.1.4 Cable/Conductor Routing and Inspection Considerations
3.2.0 Termination of Conductors/Cables to Solderless Connectors
3.2.1 Conductor Preparation
3.2.2 Crimping Tools
3.2.3 Crimping Procedure
3.2.4 Termination Inspection
3.2.5 Terminal Block Connections
3.2.6 Terminating Typical Shielded Cable
4.0.0 Solder-Type Connections
4.1.0 Soldering Safety and Components
4.1.1 Safety Considerations
4.1.2 Solder
4.1.3 Soldering Flux
4.1.4 Soldering Iron
4.2.0 Soldering Process

4.2.1 Preparing the Soldering Iron
4.2.2 Soldering Wires
4.2.3 Desoldering Wires and Components
4.2.4 Soldering Printed Circuit Board-Mounted Components
4.2.5 Terminating an RCA Connector
4.2.6 Terminating an XLR Connector

S2W11– Limited-Energy Network Installations Part 1
S2W12– Limited-Energy Network Installations Part 2
Module 33301

1.0.0 Networking History and Data Transfer
1.1.0 Networking and Its History
1.2.0 Transferring Data
1.2.1 Serial Communication
1.2.2 Parallel Communication
1.2.3 HDMI
1.3.0 Data Buses
2.0.0 OSI Reference Model
2.1.0 OSI Functional Layers
2.1.1 Protocols
2.2.0 Relating Network Protocols to the OSI Model
2.2.1 Network-LLC Service Interface
2.2.2 LLC-MAC Service Interface
2.2.3 Physical Medium Functions
2.2.4 Collision Detection and Recovery
3.0.0 Network Topology and Access Control
3.1.0 Network Topology
3.1.1 Star Topology
3.1.2 Ring Topology
3.1.3 Bus Topology
3.1.4 Hybrid Topologies
3.2.0 Network Access Control
3.2.1 Random Access
3.2.2 Polling
3.2.3 Dedicated Channel
3.2.4 Hierarchical Star Network
3.2.5 Token Passing
3.3.0 Network Security
3.3.1 Firewalls
3.3.2 Antivirus Software
4.0.0 The Internet
4.1.0 Transmission Control Protocol/Internet Protocol (TCP/IP)
4.1.1 Internet Protocol (IP)
4.1.2 Transmission Control Protocol (TCP)
4.2.0 Internet Application Protocols

4.2.1 Hypertext Transfer Protocol
4.2.2 Simple Mail Transfer Protocol
4.2.3 Post Office Protocol
4.2.4 Internet Message Access Protocol
4.2.5 Network News Transfer Protocol
4.2.6 File Transfer Protocol
4.2.7 Zigbee Protocol
4.2.8 Z-Wave Protocol
4.3.0 Cloud Storage and Computing
4.3.1 Cloud Benefits
4.3.2 Cloud Services and Computing
5.0.0 Ethernet, LANs, and PLCs
5.1.0 Ethernet Networks
5.1.1 Power over Ethernet (PoE) Systems
5.2.0 Local Area Networks
5.2.1 Basic Input/Output System (BIOS)
5.2.2 Networking Software/Network Operating Systems
5.2.3 Real-Time Performance Issues
5.2.4 Wi-Fi Standards and Compatibility
5.3.0 PLCs, Routers, Bridges, and Gateways
5.3.1 Routers, Bridges, and Gateways
5.3.2 Repeaters

Final Lab Schedule

1. Conduit to Box connections
2. Lab: Cutting, reaming and treading
3. Lab: Offsets
4. Lab: 90° bends
5. Lab: Saddle bends
6. Lab: 4 point bends
7. Final Exam Review
8. Final Exam

What to bring:

1. Notepad
2. Pens or pencils

WBFAA Semester 2 Textbook or Digital Book

Third Semester

14 WEEKS - 84 HOURS

Midterm and Final Exam = 16 in class LAB HOURS

10 Webinars @ one hour = 10 HOURS

S3W1 – DC Circuits Part I

Module 33201-10

1.0.0 Introduction

2.0.0 Atomic Theory
2.1.0 The Atom
2.2.0 Conductors and Insulators
3.0.0 Electrical Power Generation and Distribution
4.0.0 Electrical Charge and Current
4.3.1 Characteristics of Resistance
50.0 Ohm's Law
6.0.0 Schematic Representation of Circuit Elements
70.0 Resistors
7.1.0 Resistor Color Codes

WEBINAR S3W1 NFPA 72 2019 Chapter 17 Initiating Devices Part 1

S3W2 – DC Circuits Part II
Module 33201-05
8.0.0 Electrical Power
8.1.0 Power Equation
8.2.0 Power Rating of Resistors
9.0.0 DC Circuits
9.1.0 Series Circuits
9.2.0 Parallel Circuits
9.3.0 Series-Parallel Circuits
10.0.0 Solving Resistance Problems
11.0.0 Applying Ohm's Law
12.0.0 Kirchhoff's Laws
12.1.0 Kirchhoff's Current Law
12.2.0 Kirchhoff's Voltage Law
12.3.0 Loop Equations

WEBINAR S3W2 NFPA 72 2019 Chapter 17 Initiating Devices Part 2

S3W3 – AC Circuits Part I
Module 33202-10
1.0.0 Introduction
2.0.0 Sine Wave Generation
3.0.0 Sine Wave Terminology
3.1.0 Frequency
3.2.0 Wavelength
3.3.0 Peak Value
3.4.0 Average Value
3.5.0 Root-Mean-Square or Effective Value
4.0.0 AC Phase Relationships
4.1.0 Phase Angle
4.2.0 Phase Angle Diagrams

WEBINAR S3W3 NFPA 72 2019 Chapter 17 Initiating Devices Part 3-4

S3W4 – AC Circuits Part II
Module 33202-10

5.0.0 Nonsinusoidal Waveforms
6.0.0 Resistance in AC Circuits
7.0.0 Inductance in AC Circuits
7.1.0 Factors Affecting Inductance
7.2.0 Voltage and Current in an Inductive AC Circuit
7.3.0 Inductive Reactance
8.0.0 Capacitance
8.1.0 Factors Affecting Capacitance
8.2.0 Calculating Equivalent Capacitance
8.3.0 Capacitor Specifications
8.3.1 Voltage Rating
8.3.2 Leak Resistance
8.4.0 Voltage and Current in a Capacitive AC Circuit
8.5.0 Capacitive Reactance
9.0.0 RL, RC, LC and RLC Circuits
9.1.0 RL Circuits
9.1.1 Series RL Circuit
9.1.2 Parallel RL Circuits

WEBINAR S3W4 NFPA 72 2019 Chapter 17 Initiating Devices Part 5

S3W5 – AC Circuits Part III
Module 33202-10

9.2.0 RC Circuits
9.2.1 Series RC Circuit
9.2.2 Parallel RC Circuit
9.3.0 LC Circuits
9.3.1 Series LC Circuit
9.3.2 Parallel LC Circuit
9.4.0 RLC Circuits
9.4.1 Series RLC Circuit
9.4.3 Parallel RLC Circuit
10.0.0 Power in AC Circuits
10.1.0 True Power
10.2.0 Apparent Power
10.3.0 Reactive Power
10.4.0 Power Factor
10.5.0 Power Triangle
11.0.0 Transformers
11.1.0 Transformer Construction
11.2.0 Operating Characteristics

11.2.1 Energized with No Load
11.3.0 Turns and Voltage Ratios
11.4.0 Types of Transformers
11.5.0 Transformer Selection

WEBINAR S3W5 NFPA 72 2019 Chapter 17 HVAC Heating, Ventilation, and Air Conditioning

S3W6 – Semiconductors and Integrated Circuits Part I
Module 33204-10

1.0.0 Introduction
2.0.0 Semiconductor Fundamentals
2.1.0 Conductors
2.2.0 Insulators
2.3.0 Semiconductors
3.0.0 Diodes
3.1.0 Rectifiers
3.2.0 Diode Identification
4.0.0 Light-Emitting Diodes
5.0.0 Photo Diodes
6.0.0 Zener Diodes
7.1.0 NPN Transistors
7.2.0 PNP Transistors
7.3.0 Identifying Transistor Leads
7.4.0 Field-Effect Transistors
8.0.0 Silicon-Controlled Rectifiers
9.0.0 Diacs
10.0.0 Triacs
11.0.0 Printed Circuit Boards
11.1.0 Integrated Circuits
11.2.0 Microprocessors
11.3.0 Diagnostic Capability
11.4.0 Electrostatic Discharge Sensitivity
12.0.0 Operational Amplifiers

WEBINAR S3W6 NFPA 72 2019 Chapter 17 HVAC Heating, Ventilation, and Air Conditioning

S3W7 – Semiconductors and Integrated Circuits Part II
Module 33204-10

13.0.0 Basic Digital Gates
13.1.0 AND Gates
13.2.0 OR Gates
13.3.0 Amplifier
13.4.0 Inverter

13.5.0 NAND Gate
13.6.0 NOR Gate
13.7.0 Exclusive OR Gate

Semester 3 Midterm Lab Schedule

1. Review and discussion of Ohm's Law
2. Practical application of test equipment including Digital and Analog Volt/Ohm meter, and Ammeter
3. Practical identification and measuring of resistors, diodes, LEDS, transformers, Transistors.
4. Discuss Semiconductors and Integrated Circuits
5. Midterm Review
6. Midterm Exam

What to bring:
1. Notepad
2. Pens or pencils
3. WBFAA Semester 3 Textbook or Digital Book

WEBINAR S3W7 NFPA 72 2019 Chapter 17 Initiating Devices Part 6

S3W8 –Basic Test Equipment

New Module 33205-10

1.0.0 Introduction
2.0.0 Conventional Meters
2.1.0 Ammeter
2.2.0 Voltmeter
2.3.0 Ohmmeter
2.4.0 Multimeters
3.0.0 Digital Meters
3.1.0 Features
3.2.0 Operation
3.3.0 Maintenance
4.0.0 Continuity Tester
5.0.0 Voltage Tester
6.0.0 Oscilloscopes
7.0.0 Wattmeter
8.0.0 Megohmmeter
9.0.0 Line Frequency Meter
10.0.0 Power Factor Meter
11.0.0 Recording Instruments
12.0.0 Lineman's Test Set
13.0.0 Cable Toner
14.0.0 Cable Certification Testers
15.0.0 Sound Pressure Level Meters
16.0.0 RF Power Meter

17.0.0 Signal Level Meter
18.0.0 Time-Domain Reflectometer
19.0.0 Spectrum Analyzers
20.0.0 Signal Generators
21.0.0 Category Ratings
22.0.0 Testing and Troubleshooting
23.0.0 Test Equipment Safety

WEBINAR S3W8 NFPA 72 2019 Chapter 17 Initiating Devices Part 6-8

S3W9 – Power Quality and Grounding Part I
Module 33210-10
1.0.0 Introduction
2.0.0 Premises Wiring
2.1.0 Characteristics of AC Power
3.0.0 Overview of Premises Electrical System Grounding
3.1.0 Grounding System Terminology
3.2.0 General NEC® Grounding Requirements
3.3.0 System and Equipment Grounding

WEBINAR S3W9 NFPA 72 2019 Chapter 17 Initiating Devices Part 9-17

S3W10 – Power Quality and Grounding Part II
New Module 33210-10

4.0.0 Causes of Poor AC Power Quality
4.1.0 Voltage Transients and Surges
4.2.0 Voltage Swells and Sags
4.3.0 Overvoltage and Undervoltage
4.4.0 Voltage Interruptions
4.5.0 Frequency Variations
4.6.0 Harmonics
4.7.0 Noise Electromagnetic Interference
5.0.0 Power System Protection and Conditioning Equipment
5.1.0 Power Filters and Regulators
5.1.1 Isolation Transformers
5.1.2 Surge Protecting Devices
5.1.3 Voltage Regulators
5.1.4 Power Line Conditioners
5.1.5 Harmonic and Noise Suppression Filters
5.2.0 Engine-Generator Backup Power Sets
5.3.0 Static Uninterruptible Power Supply
5.3.1 Double-Conversion UPS Systems
5.3.2 Single-Conversion UPS Systems

WEBINAR S3W10 Review

S3W11 – Power Quality and Grounding Part III
New Module 33210-10

6.0.0 Direct Current Power
6.1.0 DC Power Supplies
6.1.1 Linear Power Supplies
6.1.2 Nonlinear Power Supplies
6.1.3 Selecting a Power Supply
6.1.4 Power Supply Testing
6.2.0 Battery and Battery Charger Operation
7.0.0 Cable Shielding and Grounding Techniques used to Minimize EMI
7.1.0 Cable Shields
7.2.0 Preventing Ground Loops

S3W12 –Intro to Electrical Drawings Part I
Module 33206-11

1.0.0 Introduction
1.1.0 Site Plans
1.2.0 Floor Plans
1.3.0 Elevations
1.4.0 Sections
1.5.0 Electrical Drawings
2.0.0 Drawing Layout
2.1.0 Title Block
2.2.0 Approval Block
2.3.0 Revision Block
3.0.0 Drafting Lines
3.1.0 Electrical Drafting Lines
4.0.0 Electrical Symbols

S3W13 – Intro to Electrical Drawings Part II
Module 33206-11

5.0.0 Scale Drawings
5.1.0 Architect's Scale
5.2.0 Engineer's Scale
5.3.0 Metric Scale
6.0.0 Analyzing Electrical Drawings
6.1.0 Development of Site Plans
7.0.0 Typical Site Electrical Plan
8.0.0 Power Plans
8.1.0 Key Plan
8.2.0 Symbol List
8.3.0 Floor Plan

9.0.0 Special Electrical Systems Plans

S3W14– Intro to Electrical Drawings Part III
New Module 33206-11

10.0.0 Electrical Details and Diagrams
10.1.0 Riser Diagrams
10.2.0 Wiring Diagrams
10.2.1 Point-to-Point Method
10.2.2 Cable Method
10.2.3 Baseline Method
10.2.4 Lineless (Wireless) Method
10.3.0 Schematics
10.4.0 Drawing Details
11.0.0 Written Specifications
11.1.0 How Specifications are Written
11.2.0 Format of Specifications
12.0.0 Quality Takeoffs
13.0.0 As-Built Drawings

Final Lab Schedule

1. Various Testing tools are reviewed. Usage will be demonstrated as outlined in the modules.
2. Practice reading blueprints from various trades
3. Review of Fire Alarm Plans and Electrical Plans
4. Application of 3rd semester content and how it impacts fire alarms
5. Final Exam Review
6. Final Exam

What to bring:

1. Notepad
2. Pens or pencils
3. Multimeters and a small selection of diodes, resistors and 10 feet of 2 conductor cable
4. LEDs
5. Transformers and transistors for the practice exercises
6. WBFAA Semester 3 Textbook or Digital Textbook

Fourth Semester

10 WEEKS 60 HOURS

Midterm and Final Exam = 16 in class LAB HOURS

8 Webinars @ one hour = 8 HOURS

S4W1 – Switching Devices and Timers Part I
Module 33203-10

1.0.0 Introduction
2.0.0 Switches
2.1.0 Switch Classifications
2.1.1 Switch Contacts
2.1.4 Typical Switch Wiring
2.2.0 Switch Descriptions
3.0.0 Photoelectric Devices
3.1.0 Photocell Switches
3.2.0 Solar Cells
3.3.0 Infrared Devices
3.3.1 Motion Detectors
3.4.0 Fiber-Optic Switching Devices
4.0.0 Proximity Sensors

WEBINAR S4W1 NFPA 72 2019 Chapter 18 Notification Devices

S4W2 – Switching Devices and Timers Part II
Module 33203-10

5.0.0 Electrical Relays
5.1.0 Electromechanical Relays
5.1.1 Reed Relays and Switches
5.1.2 General-Purpose Relays
5.1.4 Magnetic Relay Testing
5.2.0 Solid State Relays
5.2.1 Comparison of Electromechanical and Solid-State Relays
5.2.2 Connecting SSRs to Achieve Multiple Outputs
5.2.3 SSR Temperature Considerations
5.2.4 Solid-State Relay Overvoltage and Overcurrent Protection

WEBINAR S4W2 NFPA 72 2019 Chapter 18 Notification Devices

S4W3– Switching Devices and Timers Part III
Module 33203-10

6.0.0 Timers
6.1.0 Synchronous Time Switches
6.2.0 Solid State Timers
6.3.0 Programmable Electronic Time Switches

WEBINAR S4W3 NFPA 72 2019 Chapter 18 Notification Devices

S4W4– Limited-Energy Cable Termination Part I
Module 33209
1.0.0 Introduction
2.0.0 Coaxial Cable Terminations

2.1.0 Types of Coaxial Connections
2.2.0 Coaxial Cable Management
2.3.0 Termination of Coaxial Cable
2.3.1 Preparing the Cable End
2.3.2 Applying a BNC Connector
2.3.3 Applying an F-Type Connector
2.3.4 Applying an RCA Connector
2.4.0 Coaxial Cable Testing

WEBINAR S4W4 NFPA 72 2019 Chapter 18 Notification Devices

S4W5 – Limited-Energy Cable Termination Part II
Module 33209

3.0.0 Terminating UTP Cable
3.1.0 Types of UTP Connectors
3.2.0 UTP Cable Management
3.2.1 Check for Proper Cable Routing, Writing Scheme, and Compatible Equipment
3.2.2 Form and Dress Cables at Consolidation Points or Cross-Connect Panels
3.2.3 Determine the Length and Slack Required for Cables
3.2.4 Using Proper Cable Management Hardware
3.3.0 Typical Consolidation Point or Cross-Connect Block Termination Procedures
3.3.1 Typical Type 66 Block Termination Procedures

WEBINAR S4W5 NFPA 72 2019 Chapter 18 Emergency Comm Systems

Midterm Lab Schedule

1. Identify and select various types of switches for the specific applications
2. Select an electromechanical relay and build a holding circuit
3. Build a simple circuit using a photocell or motion detector
4. Terminating and Testing Coaxial Cable
5. Terminating UTP Cable
6. Terminating Type 110 Blocks
7. Modular Plug/Cord Fabrication and Termination
8. Midterm Exam

What to bring:

1. Notepad
2. Pens or pencils
3. WBFAA Semester 4 Textbook or Digital Book
4. Multimeters
5. Hand tools for terminating UTP cables (cable and jacks)

6. Two types of switches (be prepared to explain their style and how they function)

S4W6– Limited-Energy Cable Termination Part III
Module 33209

3.4.0 Typical Type 110 Block Termination Procedures
3.5.0 Typical Workstation Coupler or Modular Jack Termination
3.6.0 Typical Surface-Mount Box Termination Procedure
3.7.0 Modular Plug/Cord Fabrication and Termination Procedures
3.8.0 Patch Cord and 110 Block Plug Termination Procedures
3.9.0 Testing Twisted-Pair Cable

WEBINAR S4W6 NFPA 72 2019 Chapter 18 Emergency Comm Systems

S4W7– Limited-Energy Cable Termination Part IV
Module 33209

4.0.0 Solderless Connections
4.1.0 Crimp Connectors for Screw Terminals
4.2.0 Splice-Type Crimp Connections
4.3.0 Wire Nuts
4.4.0 Cable/Conductor Routing and Inspection Considerations
4.5.0 Termination of Conductors/Cables to Solderless Connectors
4.5.1 Conductor Preparation
4.5.2 Crimping Tools
4.5.3 Crimping Procedure
4.5.4 Termination Inspection
4.5.5 Terminal Block Connections
4.6.0 Terminating Typical Shielded Cable
5.0.0 Solder-Type Connectors
5.1.0 Solder
5.2.0 Soldering Flux
5.3.0 Soldering Irons
5.4.0 The Soldering Process
5.4.1 Preparing the Soldering Iron
5.4.2 Soldering Printed Circuit Board Mounted Components
5.4.4 Desoldering Wires and Components
5.5.0 Soldering Safety
5.6.0 Terminating an RCA Connector
5.7.0 Terminating an XLR Connector
6/0/0 Optical Fiber Cable Connectors
7.0.0 Legacy Communications Connectors and Terminations

WEBINAR S4W7 NFPA 72 2019 Chapter 18 Emergency Comm Systems

WEBINAR S4W8 Review

S4W8– Introduction to Codes and Standards
Module 33207-10

6.0.0 Optical Multi-Fiber Cables
7.0.0 Conductor Voltage Drop
7.1.0 Sequential Voltage Drop Method
7.2.0 Load Center Voltage Drop Method
7.3.0 End-Load Voltage Drop Method
7.4.0 Load Current Wire Selection Tables
8.0.0 Coaxial Cable Voltage Drop
9.0.0 Speaker Cable Power Drop
9.1.0 Direct-Couples Speaker Systems
9.2.0 Distributed Constant-Voltage Speaker Systems
9.3.0 Distributed Amplifier/Direct- Coupled Speaker Systems

S4W9 – Introduction to the NEC
Module 26105-20

1.0.0 Purpose and History of the NEC®
1.1.0 Evolution of the NEC®
1.2.0 NEC® Revision Process
1.3.0 Other Organizations and Laboratories
1.3.1 Nationally Recognized Testing Laboratories
1.3.2 National Electrical Manufacturers Association
1.3.3 Standards and Globalization
2.0.0 Navigating the NEC®
2.1.0 Layout of the NEC®
2.1.1 NEC Chapter 1, General
2.1.2 NEC Chapter 2, Wiring and Protection
2.1.3 NEC Chapter 3, Wiring Methods and Materials
2.1.4 NEC Chapter 4, Equipment for General Use
2.1.5 NEC Chapter 5, Special Occupancies
2.1.6 NEC Chapter 6, Special Equipment
2.1.7 NEC Chapter 7, Special Conditions
2.1.8 NEC Chapter 8, Communications Systems
2.1.9 NEC Chapter 9, Tables
2.1.10 Informative Annexes A through J
2.2.0 Finding Specific Installation Requirements
2.2.1 Installing Type SE Cable
2.2.2 Installing Track Lighting

Final Lab Schedule

1. Practice Preparing Solderless Connections
2. Practice Preparing Soldered Connections

3. NEC/NFPA Codes and Standards
4. Final Exam

What to bring:

1. Notepad
2. Pens or pencils
3. WBFAA Semester 4 Textbook
4. Solder and solder iron and wire with which to practice.
5. Safety glasses
6. NEC (NFPA 72)

Fifth Semester
12 WEEKS 72 HOURS
Midterm and Final Exam = 16 in class LAB HOURS
8 Webinars @ one hour = 8 HOURS

WEBINAR S5W1 NFPA 72 2019 Chapter 21 General Signal Requirements

S5W1 – Fiber Optics Part I
S5W2 – Fiber Optics Part II
Module 33302-04

1.0.0 Fundamentals of Fiber Optics
1.1.0 Basic Operating Theory
1.2.0 System Layout and Operation
1.2.1 Fiber Optic Advantages
1.2.2 Fiber Optic Applications
1.2.3 Light Generation and Coupling
1.2.4 Signal Propagation
1.2.5 Signal Attenuation
1.3.0 Operational Considerations
1.3.1 Speed and Bandwidth
1.3.2 Alignment
2.0.0 Optical Fiber and Cable
2.1.0 Optical Fiber Construction
2.1.1 Modes
2.1.2 Fiber Classification
2.2.0 Fiber Optic Cables
2.2.1 Buffer
2.2.2 Strength Member
2.2.3 Jacket
2.3.0 Types of Cables
2.3.1 Indoor Cables
2.3.2 Outdoor Cables
2.4.0 Cable Characteristics
2.4.1 Lengths

2.4.2 Color Coding
2.4.3 Tensile Loads
3.0.0 Light Transmission and Reception
3.1.0 Signal Types
3.1.1 Speed
3.2.0 Light Sources
3.2.1 Laser Diodes
3.2.2 VCSELs
3.2.3 LEDs
3.2.4 Small Form-Factor Pluggable (SFP) Devices
3.3.0 Receivers
3.3.1 Basic Receiver Elements
3.3.2 Speed
4.0.0 Connectors, Splices, and Splitters
4.1.0 Connectors and Splices
4.1.1 Connector Requirements
4.1.2 Intrinsic Factors
4.1.3 Extrinsic Factors
4.1.4 System-Related Factors
4.1.5 Splicing
4.2.0 Splitters
4.2.1 Basic Splitter Theory
4.2.2 Splitter Configurations
4.2.3 Splitter Construction
4.2.4 Multiplexing Splitters
4.2.5 Active Splitters
4.2.6 Optical Switches
5.0.0 Installation
5.1.0 Types of Cable Installation
5.1.1 Direct and Indirect Burial Installation
5.1.2 Aerial Installation
5.1.3 Indoor Installation
5.1.4 Installing Cable in Trays or Ducts
5.1.5 Installation in Conduit and Innerduct
5.1.6 Blown Fiber Installation
5.1.7 Pulling Fiber Optic Cables
5.2.0 Enclosures and Organizers
5.3.0 Distribution Hardware
6.0.0 Terminating Fiber Optic Cable
6.1.0 Mechanical Considerations
6.2.0 Connector Structure
6.3.0 Connector Types
6.3.1 Subscriber Connectors (SCs)
6.3.2 Straight Terminus (ST) Connectors
6.3.3 Lightwave Connectors (LC)
6.3.4 Mass Termination RJ-45 (MT-RJ) Connectors

6.3.5 Fiber Distributed Data Interface (FDDI) Connectors
6.3.6 Face Contact (FC) Connectors
6.3.7 MPO Connectors
6.3.8 Other Connector Formats
6.4.0 Connector Installation
7.0.0 Splicing and Testing Optical Fibers
7.1.0 Applications and Types of Fiber Splices
7.1.1 Fusion Splicing
7.1.2 Mechanical Splicing
7.2.0 Splicing Issues
7.2.1 Attenuation
7.2.2 Strength
7.2.3 Ease of Splicing
7.2.4 Splice Protection
7.3.0 Fiber Optic Testing
7.3.1 Optical Power Meter
7.3.2 Insertion Loss Testing and Mode Control
7.3.3 Fiber Loss Measurements
7.3.4 Time and Frequency Domains
7.3.5 Optical Time-Domain Reflectometry

WEBINAR S5W2 NFPA 72 2019 Chapter 23 Protected Prem Fire Alarms
WEBINAR S5W3 NFPA 72 2019 Chapter 23 Combo Systems

S5W3 – Wireless Communication Part I
S5W4 – Wireless Communication Part II
Module 33303-04

1.0.0 Basic Principles of Wireless Communication
1.1.0 Wireless Communication Principles
1.1.1 Modulation
1.1.2 Analog and Digital Signals
1.1.3 Multiplexing
2.0.0 Radio Frequency (RF) Systems
2.1.0 Radio Frequency (RF) System Components
2.1.1 Transmitters
2.1.2 Receivers
2.1.3 Antennas
2.1.4 Transceivers
2.1.5 Repeaters
2.1.6 Waveguide
2.2.0 Test Equipment
2.2.1 RF Field Strength Analyzer
2.2.2 RF Analyzer/Standing Wave Meter
2.2.3 RF Power Meter
2.2.4 Spectrum Analyzer

2.3.0 Infrared (IR) Systems
2.3.1 Basic IR Components
2.3.2 Remote Control Circuits
2.3.3 Remote Control Distribution Systems
2.3.4 Data Transmission Interface Systems
2.3.5 IR Beam-Break Alarm Systems
3.0.0 Wireless Computer Networks
3.1.0 Wireless Network Development
3.2.0 Wireless Network Applications
3.3.0 WLAN Equipment
3.3.1 Wireless Network Security
4.0.0 Satellite Communications
4.1.0 Satellite Communication System Overview
4.1.1 Areas of Service
4.2.0 Satellite Orbits and Signal Meters
4.2.1 Satellites in Geostationary Orbits
4.2.2 Satellites in Low Earth Orbit
4.2.3 Satellite Signal Meter
5.0.0 Antenna Installation
5.1.0 Installation Requirements
5.1.1 Antenna Setup
5.1.2 Antenna Placement
5.2.0 Electromagnetic Interference (EMI)

WEBINAR S5W4 NFPA 72 2019 Chapter 26 Supervising Station Alarm Systems

S5W5 – Broadband
Module 33403
1.0.0 Broadband Basics
1.1.0 Broadband Fundamentals and Related Math
1.1.1 Metric System Prefixes
1.1.2 Scientific Notation
1.1.3 Frequency Spectrum
1.1.4 Units of Measurement
2.0.0 Broadband Delivery and Networks
2.1.0 Delivery Technologies
2.1.1 Dial-up
2.1.2 Digital Subscriber Line (DSL) and Asymmetric Digital Subscriber Line (ADSL)
2.1.3 Coaxial Cable
2.1.4 Fiber Optic Cable
2.1.5 Broadband Over Power Line (BPL)
2.1.6 Mobile Broadband
2.1.7 Fixed Wireless
2.1.8 Point-to-Point (P2P) Wireless
2.1.9 Satellites

2.2.0 Network Topologies
2.2.1 Ring Topology
2.2.2 Bus Topology
2.2.3 Star Topology
2.2.4 Mesh Topology
2.2.5 Hybrid Topology
2.2.6 Wi-Fi® Devices
3.0.0 CATV Architecture, Headend, and Distribution Components
3.1.0 CATV System Architecture
3.1.1 Common CATV Symbols
3.1.2 Distribution System and Subscriber Drops
3.1.3 MATV and SMATV Architecture
3.2.0 Headend Signal Processing and Alignment
3.2.1 Types of Processing
3.2.2 Headend Components and Alignment
3.2.3 Satellite Receiving Antennas and Downconverters
3.2.4 Processors
3.2.5 Demodulators and Modulators
3.2.6 Headend Alignment
3.3.0 Distribution System Components
3.3.1 Distribution Amplifiers and Line Extenders
3.3.2 Splitters
3.3.3 Directional Couplers and Taps
3.3.4 Attenuators and Terminators
3.3.5 Coaxial Cables
3.4.0 CATV Distribution Topologies
3.4.1 Home Run Cable Distribution Systems
3.4.2 Loop Through Cable Distribution Systems
3.4.3 Trunk-and-Branch Cable Distribution Systems
4.0.0 System Gains and Losses and Troubleshooting
4.1.0 Distribution System Gains and Losses
4.1.1 Cable Losses
4.1.2 Splitter Losses
4.1.3 Directional Coupler/Tap Losses
4.1.4 Calculating Distribution System Gains and Losses
4.2.0 Troubleshooting
4.2.1 Systematic Approach
4.2.2 Customer Interface
4.2.3 Physical Examination of the System
4.2.4 Basic System Analysis
4.2.5 The Use of Manufacturers' Troubleshooting Aids
4.2.6 Cable Tone Test Set
4.2.7 Troubleshooting the Distribution System
4.2.8 Troubleshooting the Headend

WEBINAR S5W5 NFPA 72 2019 Chapter 26 Supervising Station Alarm Systems

S5W6 – Media Management Systems

Module 33404

1.0.0 Media Management Systems
1.1.0 MMS Basics
1.1.1 Software
1.2.0 System Types
1.2.1 Digital Library Systems
1.2.2 Content-on-Demand Systems
2.0.0 Video Display Components
2.1.0 Video Equipment
2.1.1 Local Control Units (LCUs)
2.1.2 Television Monitors
2.1.3 Speakers
2.1.4 Video Projectors
2.1.5 Computers and Laptops
2.1.6 Displays and Monitors
3.0.0 File Storage, Retrieval, and Playback
3.1.0 Digital File Formats and Conversion
3.1.1 File Formats
3.1.2 Cloud-Based Digital Data
3.1.3 Digital Video Servers
3.1.4 Presentation Players
3.2.0 Digital Data Storage
3.2.1 Hard Disk Drives
3.2.2 RAID Systems
3.2.3 Cloud Storage
3.2.4 Magneto-Optical Storage
3.2.5 DVD and Blu-rayTM
3.2.6 WORM Storage
3.3.0 Content Players and Broadcast Sources
3.3.1 Compact Disc (CD) Players
3.3.2 High-Definition DVD Players
3.3.3 Digital Video Recorder (DVR)
3.3.4 Video Cameras
3.3.5 Broadcast Sources
4.0.0 Network Infrastructure
4.1.0 Video Transmission
4.1.1 Broadband
4.1.2 Baseband
4.1.3 Data Network
4.1.4 Audio/Video Transmission Equipment
4.1.5 Content Scheduling

WEBINAR S5W6 NFPA 72 2019 Chapter 26 Continued

S5W7– Telecommunication Systems

Module 33405

1.0.0 History, Loops, and Switches
1.1.0 Telecommunications History and POTS
1.1.1 Early Telephones and Switches
1.1.2 Plain Old Telephone Services
1.2.0 Central Office (CO) Services
1.2.1 Analog Loop-Start Signaling
1.2.2 Telephone Numbers
1.2.3 Analog Ground-Start Signaling (PBX)
1.2.4 E&M Tie Line and Trunk Signaling
1.2.5 Two-Wire E&M Circuits
1.2.6 Four-Wire E&M Circuits
1.2.7 Foreign Exchange Service
1.2.8 Off-Premise Station Lines (OPX)
1.2.9 Private Line Automatic Ringdown (PLAR) Circuits
1.2.10 Pulse Dialing
1.2.11 Touch-Tone® Dialing
2.0.0 Telecommunication Exchange Switching Systems
2.1.0 Types of Switching Systems
2.1.1 PBX Systems
2.1.2 Key Telephone Systems
2.1.3 Electronic Key Service Units
2.1.4 Hybrid Systems
3.0.0 Multiplexing
3.1.0 Multiplexing Technologies
3.1.1 Analog Voice to Digital Voice Conversion
3.1.2 Pulse Code Modulation (PCM)
3.1.3 Digital Transmission Level 1 Signals (T-1)
3.1.4 Digital Transmission Level 3 Signals (T-3)
4.0.0 Other Voice and Data Transmission Services
4.1.0 Digital Services and Digital Subscriber Lines
4.1.1 Digital Services
4.1.2 Digital Subscriber Line (DSL)
4.1.3 Modems and Gateways
4.2.0 Digital Voice Services
4.2.1 Pair Gain Systems
4.2.2 Channel Banks
4.2.3 Integrated Services Digital Network (ISDN)
4.2.4 Voice Over Internet Protocol (VoIP)
4.2.5 VoIP and IoT

WEBINAR S5W7 Special Hazards

MIDTERM LAB

1. Lab: Determining the correct gauge wire for specific wire lengths at specific voltages and loads. Identify the proper cable to be used for an application. Demonstrate their understanding of cable markings.
2. Lab: Demonstrate the installation of fiber-optic cabling and support equipment.
3. Lab: Review / Demonstrate simple computer network components.
4. Lab: Review / Demonstrate simple X-10 (PLC) applications.
5. Lab: Demonstrate proper method of striping coaxial cable and installing connectors.
6. Fill out the state application for certification for submission in last year of program.
7. Fire/Life Safety Certification Prep
8. Practice Test for State of California Fire/Life Safety Certification Exam on www.wbfaatraining.net
9. Mid-Term Review
10. Mid-Term Exam

What to bring:

1. Notepad
2. Pens or pencils
3. WBFAA Semester 5 Textbook or Digital copy

S5W8– The Internet of Things (IoT)

Module 33412

1.0.0 Internet of Things (IoT)
1.1.0 IoT History and Developments
1.1.1 Cellular Improvements
1.1.2 Current Trends
1.2.0 Technologies and Developments
1.2.1 Internet and Data Drivers
1.2.2 Cloud Storage
1.2.3 Cloud Computing Services
1.2.4 Servers
1.2.5 Unified Architecture Protocol and M2M
2.0.0 Components and Networks
2.1.0 Hardware
2.1.1 Sensors
2.1.2 Programmable Logic Controllers (PLCs)
2.1.3 Smartphones
2.1.4 Digital Personal Assistants
2.2.0 Wi-Fi®, Bluetooth®, and Cellular Networks
2.2.1 Wi-Fi® Devices
2.2.2 Bluetooth® and Mesh Networks
2.2.3 Cellular Networks
2.2.4 Software/Firmware Updates
2.3.0 Video and Data
2.3.1 Digital Video Servers
2.3.2 Video Cameras

2.3.3 DVR/NVR and Cloud Services
2.3.4 RAID Systems
3.0.0 IoT Applications
3.1.0 Home and Business
3.1.1 Residential Applications
3.1.2 Building Automation Applications
3.1.3 Industrial Applications
3.1.4 Warehouse Applications
3.1.5 Construction Applications
3.1.6 Manufacturing and Logistics
3.1.7 Healthcare and Pharmaceutical Applications
3.2.0 Future IoT Applications
3.2.1 Healthcare
3.2.2 Autonomous Automobiles
3.2.3 Weather Data
3.2.4 Smart Cities
3.2.5 Remote Learning
3.2.6 Home Utilities
4.0.0 IoT Impacts
4.1.0 IoT Challenges
4.1.1 Information Security
4.1.2 Privacy Issues
4.1.3 System Compatibility and Connectivity
4.1.4 Scalability and Bandwidth
4.1.5 Technology Standards

WEBINAR S5W8 Household

S5W9 – Site Survey, Project Planning and Documentation Part I
S5W10– Site Survey, Project Planning and Documentation Part II
Module 33304
1.0.0 Estimating for a Bid
1.1.0 Job Estimating and Bidding
1.1.1 Decision to Bid
1.1.2 The Estimating Process
1.1.3 Completing the Estimate
1.1.4 Management Approval
1.1.5 Preparing and Submitting the Bid
1.2.0 Reviewing Job Requirements
1.2.1 Construction Drawings
1.2.2 Specifications
1.2.3 Scope of Work
2.0.0 After the Contract is Awarded
2.1.0 Survey and Planning Steps
2.1.1 Performing the Site Survey
2.1.2 Site Checklist

2.2.0 Scheduling Work and Acquiring Materials
2.2.1 Schedule Development
2.2.2 Job Constraints
2.2.3 Tracking Progress
2.2.4 Acquiring Materials and Equipment
2.3.0 Assigning the Installation Crew
2.3.1 Pre-Installation Meeting
2.3.2 Completing the Installation
2.3.3 Quality Control and Acceptance Tests
2.3.4 Completing the Punch List
2.3.5 Completing the Job
3.0.0 Tenant Installations
3.1.0 Similarities and Differences
3.1.1 Tenant Installation Process Steps
3.1.2 Performing the Site Survey
4.0.0 Additional Documentation
4.1.0 Contractual and Legal Documents
4.1.1 Addenda
4.1.2 Liens
4.1.3 Stop-Work Orders
4.1.4 Requests for Information
4.1.5 Change Orders
4.1.6 Project Logs
4.1.7 Record of Completion
4.1.8 Operation and Maintenance Manuals
4.1.9 Schedule Impairment Report
4.1.10 Wiring Certification Diagrams and Lists

S5W11– System Commissioning and User Training
Module 33306

1.0.0 System Commissioning
1.1.0 Pre-Installation Activities and Plan Preparation
1.2.0 Installation Activities
1.3.0 Functional Performance Testing Activities
1.4.0 User Training and Documentation
1.4.1 As-Built and Record Drawings
1.5.0 System Acceptance
1.5.1 Post-Acceptance Activities
2.0.0 User Training
2.1.0 Training Scope and Preparation
2.1.1 Training Scope
2.1.2 Determine Requirements for Training
2.1.3 Training Preparation
2.1.4 Trainee Qualifications
2.1.5 Equipment/System Preparation
2.2.0 Conduct the Training

2.2.1 Course Introduction
2.2.2 Demonstration and Hands-On Practice
2.2.3 Safety Considerations
2.2.4 Guiding Learner Performance
2.2.5 Classroom Instruction
2.3.0 On-the-Job Learning
2.3.1 Preparing for OJL
2.3.2 Presenting OJL
2.3.3 Tryout Learner Performance During OJL
2.3.4 Evaluating OJL Performance
2.3.5 Course Closure

S5W12 Maintenance and Repair
Module 33307
1.0.0 Maintenance and Repair Basics
1.1.0 Causes of Failures
1.1.1 Environmental Conditions
1.1.2 Improper Installation
1.1.3 Poor Power Quality
1.1.4 Operator Error
1.1.5 Electrostatic Discharge
1.2.0 Common Causes of Electrical Equipment Faults
1.2.1 Short Circuits
1.2.2 Open Circuits
1.2.3 Ground Faults
1.2.4 Mechanical Failures
1.3.0 Test Equipment
2.0.0 Troubleshooting Process
2.1.0 A Systematic Approach
2.1.1 Customer Interface
2.1.2 Physical Examination of the System
2.1.3 Basic System Analysis
2.2.0 Manufacturers' Troubleshooting Aids
2.2.1 Wiring Diagrams
2.2.2 Troubleshooting Tables and Fault Isolation Diagrams
2.2.3 Diagnostic Equipment and Tests
3.0.0 Fault Isolation and Maintenance
3.1.0 Troubleshooting Power Input and Supply Circuits
3.1.1 Input Voltage Check
3.1.2 Low-Voltage Transformer Checks
3.1.3 Troubleshooting Power Supplies
3.2.0 Troubleshooting Control and Central Processing Circuits
3.2.1 Control Circuits
3.2.2 Central Processing Circuits
3.3.0 Troubleshooting Copper Cable
3.3.1 Incorrect Connections, Opens, Shorts, and Grounds

3.3.2 Signal Loss
3.3.3 Incorrect Impedance
3.3.4 Excessive Cable Attenuation
3.3.5 Excessive Near-End Crosstalk
3.3.6 Noise
3.4.0 Troubleshooting Fiber Optic Cable, Hardware, and Software
3.4.1 Fiber Optic Cable
3.4.2 Hardware and Software
3.5.0 Periodic Preventive Maintenance
3.5.1 Inspection
3.5.2 Cleaning
3.5.3 Lubrication
3.5.4 Testing and Adjustment
3.5.5 Inspecting and Testing Forms

Final Lab Schedule

1. Lab: Installing a wireless computer network
2. Lab: Review sample specifications, contracts and construction drawings for the installation of a low-voltage system
3. Lab: Review / demonstrate simple wireless computer network components
4. Lab: Review basic components of CCTV system / DVR / software
5. Fire/Life Safety Certification Prep
6. Completing an Electrician Certification Exam form
7. Practice Test for State of California Fire/Life Safety Certification Exam
8. Final Exam Review
9. Final Exam

What to bring:

1. Notepad
2. Pens or pencils
3. WBFAA Semester 5 Book Digital Copy

Sixth Semester
12 WEEKS -72 HOURS
Midterm and Final Exam = 16 in class LAB HOURS
7 Webinars @ one hour = 7 HOURS

WEBINAR S6W1 NFPA 72 2019 Chapter 14 -7 Inspection and Testing/Documentation
WEBINAR S6W2 NFPA 72 2019 Chapter 14 Inspection and Testing
WEBINAR S6W3 NFPA 72 2019 Chapter 14 Inspection and Testing

S6W1 – Intrusion Detection Systems Part I
S6W2 – Intrusion Detection Systems Part II
S6W3 – Intrusion Detection Systems Part III
S6W4 – Intrusion Detection Systems Part IV

Module: 33407

1.0.0 Fundamentals of Intrusion Detection Systems
1.1.0 System Components and Types
1.1.1 Local and Monitored Systems
1.1.2 Primary System Types
2.0.0 Types of Intrusion System Sensors
2.1.0 Perimeter Sensors and Detectors
2.1.1 Magnetic Switch Sensors
2.1.2 Glass-Break Detectors
2.1.3 Burglar Alarm Screens
2.1.4 Shock (Vibration) Detectors
2.1.5 Structural-Attack Piezoelectric Sensors
2.1.6 Electric Field (Capacitive) Sensors
2.1.7 Coaxial Cable Systems
2.1.8 Buried Line Intrusion (Seismic) Sensors
2.1.9 Outdoor Microwave Sensors
2.1.10 Active Infrared (Photoelectric Beam) Sensors
2.1.11 Microphonic Sensor Cable
2.1.12 Fiber Fence Security
2.2.0 Interior Sensors
2.2.1 Microwave Detectors
2.2.2 Passive Infrared (PIR) Sensors
2.2.3 Photoelectric Detectors
2.2.4 Pressure Mats
2.2.5 Stress Sensors
2.2.6 Audio Sensors
2.2.7 Capacitance Proximity Sensors
2.2.8 Protected Distribution System
3.0.0 Annunciation (Notification) Devices
3.1.0 Types of Annunciation Devices
3.1.1 Strobes
3.1.2 Bells, Buzzers, Horns, Chimes, and Sirens
4.0.0 Control Panels and Units
4.1.0 Control Units and Combination Systems
4.1.1 Control Points
4.1.2 Touch Screens
4.1.3 Application-Based Controls
4.1.4 Wireless and Computer Controls
4.1.5 Control Unit Outputs
5.0.0 Intrusion System Notification
5.1.0 Communications and Monitoring
5.1.1 Communications Modes
5.1.2 Monitoring Options
5.2.0 Communication Methods and Systems
5.2.1 Internet
5.2.2 Fiber Optic

5.2.3 Long-Range Radio or Satellite
5.2.4 Digital Alarm Communicator Transmitters
5.2.5 Cellular or Digital
5.2.6 Facilities-Based VoIP
6.0.0 System Design
6.1.0 Applications
6.1.1 Motion Detectors
6.1.2 Selecting Appropriate Sensors
6.1.3 Combined Technology Sensors
6.1.4 Concealment
6.1.5 Walk Test Lights
6.2.0 Methods for Connection
6.2.1 Hardwired Systems
6.2.2 Wireless Systems
6.2.3 Zones
6.2.4 Conditions
6.2.5 Zone-Programming Options
6.2.6 Alarm Verification
6.2.7 Circuit Response Time
6.3.0 False Alarm Prevention and False Alarm Control Teams (FACT)
6.3.1 Programming Options
7.0.0 Equipment Installation
7.1.0 General Guidelines
7.1.1 General Wiring Requirements
7.1.2 Workmanship
7.1.3 Access
7.1.4 Circuit Identification
7.1.5 Power-Limited Circuits in Raceways
7.1.6 Mounting of Detector Assemblies
7.1.7 Outdoor Wiring
7.1.8 Fire Seals
7.1.9 Wire in Air Handling Spaces
7.1.10 Wiring in Hazardous Locations
7.1.11 Wet or Corrosive Environments
7.1.12 Underground
7.1.13 Remote Control Signaling Circuits
7.1.14 Wiring Protection
7.1.15 Floor-to-Floor Cables
7.1.16 Cables in Raceways
7.1.17 Raceways as Cable Support
7.1.18 Cable Spacing
7.1.19 Elevator Shafts
7.1.20 Wiring Methods
7.1.21 Primary Power
7.1.22 Secondary Power

7.1.23 Grounding
8.0.0 Tips for Installation
8.1.0 Standby Power and Components
8.1.1 Minimum Secondary Power
8.1.2 Control Units
8.1.3 Perimeter Sensors
8.1.4 Magnetic Reed Switch
8.2.0 Perimeter Fence or Exterior Detection Systems
8.2.1 Outdoor Microwave Sensors
8.2.2 Outdoor Active Infrared Pulsed Multibeam Photoelectric Units
8.3.0 Interior Intrusion Systems
8.3.1 PIR Sensors
8.3.2 Microwave Transceivers
8.3.3 Proximity and Combined Technology Sensors
9.0.0 Programming Options
9.1.0 Controlled and 24-Hour Zones
9.1.1 Entry and Exit Delays
9.1.2 Delayed and Instant Zones
9.1.3 Perimeter and Interior Zones
9.1.4 Home and Away Feature
9.1.5 Interior and Perimeter Follower Zones
9.1.6 Panic, Duress, Medical, and Fire Zones
10.0.0 Inspection, Testing, and Maintenance
10.1.0 Testing
10.1.1 Before Testing
10.1.2 Precautions for Occupied Buildings
10.1.3 General Requirements
10.1.4 Testing Methodology
10.1.5 After Testing
10.2.0 Intrusion System Troubleshooting Guidelines

WEBINAR S6W4 NFPA 72 2019 Chapter 14 Inspection and Testing

S6W5 - CCTV Systems
Module 33410

1.0.0 CCTV Technologies
1.1.0 Digital and Analog
1.1.1 Analog
1.1.2 Digital IP
1.1.3 Analog and Digital Waveforms
1.1.4 Digital Technology and CCTV Networks
1.2.0 Internet-Based Surveillance Systems
1.2.1 Transmission Control Protocol/Internet Protocol
1.2.2 Client-Server CCTV

1.2.3 Cloud and Web Services
1.2.4 Smart CCTV
2.0.0 Camera Types and Components
2.1.0 Surveillance Applications and Camera Types
2.1.1 Low-Light and Infrared
2.1.2 Covert/Hidden
2.1.3 Panoramic Cameras
2.1.4 Enclosures
2.2.0 DVRs/NVRs, Monitors, and Components
2.2.1 DVRs and NVRs
2.2.2 Video Monitors
2.2.3 CCTV Keyboards
2.2.4 CCTV Cables and Power Supply
3.0.0 CCTV Imaging
3.1.0 CCTV Sensors and Images
3.1.1 CCD
3.1.2 CMOS
3.1.3 Scanning
3.1.4 Processing
3.1.5 Resolution
3.2.0 Lighting and Illumination
3.2.1 Natural Light
3.2.2 Artificial Light
3.2.3 Measuring Light
3.2.4 Measuring Reflectivity
3.2.5 Light Sensitivity of Cameras
3.2.6 Infrared Lighting and Cameras
3.2.7 Illumination and Beam Angles
3.2.8 Managing Backlighting
3.3.0 The Camera Lens
3.3.1 Lens Size
3.3.2 Lens Mount
3.3.3 Focal Length
3.3.4 Field of View
3.3.5 The Iris
3.3.6 F-Stop and Depth of Field
4.0.0 Video Management
4.1.0 Video Encoding
4.1.1 Standalone and Rack Mount Encoders
4.1.2 Video Compression
4.1.3 Codec
4.1.4 Types of Compression
4.2.0 Architecture and Storage
4.2.1 Server-Based vs. Cloud-Based
4.2.2 Smart Devices
4.2.3 Open and Vendor Specific

4.2.4 Video Management Software
4.3.0 Video Hosting and Security
4.3.1 Using Web Services to Archive
4.3.2 Web/Cloud Services and IoT
4.3.3 Subscribing
4.3.4 Installing
4.3.5 Audits
4.3.6 Data Security
4.4.0 Integrated Systems and Intelligent Video
4.4.1 Integrated Systems
4.4.2 Intelligent Video
5.0.0 CCTV Networks
5.1.0 Network Technology
5.1.1 Network Video Recorders (NVRs)
5.1.2 Network and User Authentication
5.1.3 Encryption and Decryption
5.1.4 OSI
5.1.5 TCP and OSI
5.1.6 IP Addressing
5.1.7 Network Security
5.1.8 Connections
5.2.0 Wired Networks
5.2.1 Cabling
5.2.2 Ethernet
5.2.3 Power Over Ethernet (PoE)
5.2.4 Physical Equipment
5.3.0 Signal Propagation
5.3.1 CCTV Signal Amplifiers
5.3.2 Distribution Amplifiers for CCTV
5.3.3 Signal-to-Noise Ratio
5.3.4 The Importance of Impedance Matching
5.3.5 Ground Loops
5.3.6 The Advantages of Fiber Optic Cable in CCTV Applications
5.4.0 Wireless Networks
5.4.1 Wireless Camera Setup
5.4.2 Signal Strength and Antennas
5.4.3 Architectures
5.4.4 Wireless Protocols
5.4.5 Wireless Security
5.4.6 Wi-Fi® and Bluetooth®
6.0.0 System Planning, Installing, and Testing
6.1.0 Planning
6.1.1 Camera Selection
6.1.2 Lens Selection
6.1.3 Lighting and Illumination
6.1.4 Recording and Viewing Needs

6.1.5 Storage Considerations
6.1.6 Networking and Cabling
6.2.0 CCTV Setups
6.2.1 Multiple Cameras with a Switcher
6.2.2 Viewing Multiple Cameras with a Splitter
6.2.3 Viewing Multiple Cameras with a Multiplexer
6.3.0 Selecting a Camera
6.3.1 Mounting Types
6.3.2 Indoor Cameras
6.3.3 Outdoor Cameras
6.3.4 High-Security Cameras
6.3.5 Specialty Housings
6.3.6 Dome Housings
6.3.7 Placement and Positioning
6.4.0 Large Installations and Testing
6.4.1 CCTV Rack Systems
6.4.2 CCTV Console Systems
6.4.3 Matrix Switchers
6.4.4 Matrix Switchers in Large CCTV Installations
6.4.5 Testing CCTV Systems

WEBINAR S6W5 NFPA 72 2019 Chapter 7 Documentation

S6W6 Access Control Systems
Module 33411

1.0.0 Access Control Basics
1.1.0 Access Control System Elements
1.2.0 Access Control System Technologies
1.2.1 Non-Staffed Systems
1.2.2 Non-Staffed System Considerations
1.2.3 Protective Distribution Systems
2.0.0 Control Barriers and Locking Devices
2.1.0 Gates
2.1.1 Swing Gates
2.1.2 Sliding Gates
2.1.3 Anti-Ram Sliding Gates
2.1.4 Drop-Bar Gates
2.1.5 Anti-Ram Cable-Beam Gates
2.1.6 Pop-Up Barriers
2.2.0 Turnstiles, Revolving Security Doors, and Mantraps
2.2.1 Turnstiles
2.2.2 Revolving Security Doors
2.2.3 Mantraps
2.3.0 Doors
2.4.0 Locking Devices

2.4.1 Electric Strikes
2.4.2 Electric Bolt Locks
2.4.3 Electric Locksets (Latches)
2.4.4 Electromagnetic Locks
2.4.5 Exit Devices
2.4.6 Cable Supervision
2.4.7 Door Status Devices
3.0.0 Access Readers and Coded Credentials
3.1.0 Reader Categories
3.1.1 Swipe, Insert, and Proximity Readers
3.1.2 Biometric Readers
3.2.0 Coded Credentials
3.2.1 Magnetic Stripe Cards
3.2.2 Wiegand Wire Cards
3.2.3 Proximity Cards and Devices
3.2.4 Smart Cards
3.2.5 Smartphones
4.0.0 Controllers, Power Supplies, Topologies, and Communications
4.1.0 Controllers
4.2.0 Power Supplies
4.3.0 Topologies
4.4.0 Communications
5.0.0 Installation Tips and Procedures
5.1.0 Installation Tips
5.1.1 Best Practices
5.2.0 Installation Procedures

Sixth Semester Midterm Lab Schedule

1. Active Discussion of Intrusion Detection System (IDS) Components and Applications
2. Active Discussion of Access Control System (ACS) Components and Integration to IDS
3. Active Discussion of CCTV/IPTV System Components and Integration to IDS and ACS
4. Review of proper test and inspection procedures. Review of NFPA test and inspection form.
5. Midterm Review (Modules 33407, 33410, 33411)
6. Midterm Exam

What to bring:

1. Notepad
2. Pens or pencils
3. Electronic Systems Technician: Level 4 Textbook Edition 4
4. 2020 Edition NFPA 70, the National Electric Code (if possible)

5. 2019 Edition NFPA 72, the National Fire Alarm Code, without the California Amendments (if possible)

WEBINAR S6W6 Review
WEBINAR S6W7 California Fire Code Requirements/Review

S6W7 Fire Alarm Systems Part I
S6W8 Fire Alarm Systems Part II
S6W9 Fire Alarm Systems Part III
S6W10 Fire Alarm Systems Part IV

Module 33408

1.0.0 Codes and Standards
1.1.0 Standards Organizations
1.2.0 The National Fire Protection Association
1.2.1 NFPA Codes
1.2.2 NFPA Standards
2.0.0 Fire Alarm Systems Overview
2.1.0 Fire Alarm Communication Systems
2.1.1 Conventional Hardwired Systems
2.1.2 Addressable Intelligent Systems
2.2.0 Fire Alarm System Equipment
2.2.1 Fire Alarm Initiating Devices
2.2.2 Conventional versus Addressable Commercial Detectors
2.2.3 Automatic Detectors
2.2.4 Heat Detectors
2.2.5 Smoke Detectors
2.2.6 Other Types of Detectors
2.2.7 Manual (Pull Station) Fire Detection Devices
2.2.8 Auto-Mechanical Fire Detection Equipment
3.0.0 Control Units
3.1.0 Control Unit Overview
3.1.1 FACU Primary and Secondary Power
3.1.2 FACU Listings
3.2.0 User Control Points
3.2.1 Keypads
3.2.2 Touch Screens
3.2.3 Telephone/Computer Control
3.3.0 FACU Initiating Circuits and Outputs
3.3.1 Initiating Circuit Zones
3.3.2 Alarm Verification
3.3.3 FACU Labeling
3.3.4 Types of FACU Alarm Outputs
4.0.0 Notification, Communication, and Monitoring
4.1.0 Notification Appliances
4.1.1 Visual Notification Devices
4.1.2 Audible Notification Devices

4.1.3 Voice Evacuation Systems
4.2.0 Signal Considerations
4.3.0 Communication and Monitoring
4.3.1 Monitoring Options
4.3.2 Digital Alarm Communicator Transmitters
4.3.3 Cellular, IP, and Radio Signal Transmission
4.3.4 Cellular Backup
5.0.0 Installation Guidelines
5.1.0 General Wiring Requirements
5.2.0 Installation Requirements
5.2.1 Access to Equipment
5.2.2 Fire Alarm Circuit Identification
5.2.3 Power-Limited Circuits in Raceways
5.2.4 Mounting of Detectors
5.2.5 Outdoor Wiring
5.2.6 Fire Seals
5.2.7 Wiring in Air Handling Spaces
5.2.8 Wiring in Hazardous Locations
5.2.9 Remote Control Signaling Circuits
5.2.10 Floor-to-Floor Cables
5.2.11 Cables in Raceways
5.2.12 Cable Spacing
5.2.13 Elevator Shafts
5.2.14 Terminal Wiring Methods
5.2.15 Initiation Device Circuits
5.2.16 Notification Appliance Circuits
5.2.17 Primary Power Requirements
5.2.18 Secondary Power Requirements
5.3.0 Total Premises Fire Alarm System Installation
5.3.1 Manual Fire Alarm Box (Pull Station) Installation
5.3.2 Flame Detector Installation
5.3.3 Smoke Compartment, Smoke Spread, and Stratification
5.3.4 General Precautions for Detector Installation
5.3.5 Spot Detector Installations on Flat, Smooth Ceilings
5.3.6 Photoelectric Beam Smoke Detector Installations on Flat, Smooth Ceilings
5.3.7 Spot Detector Installations on Irregular Ceilings
5.3.8 Notification Appliance Installation
5.3.9 Fire Alarm Control Unit Installation Guidelines
5.4.0 Fire Alarm-Related Systems
5.4.1 Ancillary Control Relay
5.4.2 Duct Smoke Detectors
5.4.3 Elevator Recall
5.4.4 Special Door Locking Arrangements
5.4.5 Suppression Systems
5.4.6 Supervision of Suppression Systems

5.5.0 Troubleshooting
5.5.1 Alarm System Troubleshooting Guidelines
5.5.2 Addressable System Troubleshooting Guidelines

S6W11 Overview of Nurse Call and Signaling Systems
Module 33409

1.0.0 Nurse Call Systems and Related Codes
1.1.0 Nurse Call Terms and Standards
1.1.1 Terminology
1.1.2 Codes and Standards
2.0.0 Managing Nurse Call Systems
2.1.0 Call System Types and Call Management
2.1.1 Visual Systems
2.1.2 Audiovisual Systems
2.1.3 Computer-Based Audiovisual Systems
2.1.4 Call Management
2.1.5 Systems in Skilled Nursing and Assisted Living Facilities
3.0.0 Interfacing with Call Systems
3.1.0 System Interfaces
3.1.1 Telephone Equipment
3.1.2 Entertainment Equipment
3.1.3 Pagers and Smartphones
3.1.4 Fire Alarm Systems
3.1.5 Security Systems
3.1.6 Auxiliary Alarm Devices
3.1.7 Computers and Printers
4.0.0 Nurse Call System Installation and Commissioning
4.1.0 Electrical Power Requirements
4.1.1 Electrical Systems
4.1.2 Backup Power
4.2.0 Installation and Commissioning Guidelines
4.2.1 Electrical Guidelines
4.2.2 Location of Equipment
4.2.3 Electrical Safety Considerations
4.2.4 System Wiring and Cabling
4.2.5 Programming
4.2.6 System Checkout/Commissioning

S6W12 Residential and Commercial Building Networks
Module 33406

1.0.0 Systems Integration
1.1.0 Today's Integrated Systems
1.1.1 Examples of Systems Integration
1.1.2 Reasons for Systems Integration
2.0.0 The OSI Reference Model
2.1.0 OSI Layers

2.1.1 Layer 1 — The Physical Layer
2.1.2 Layer 2 — The Data Link Layer
2.1.3 Layer 3 — The Network Layer
2.1.4 Layer 4 — The Transport Layer
2.1.5 Layer 5 — The Session Layer
2.1.6 Layer 6 — The Presentation Layer
2.1.7 Layer 7 — The Application Layer
3.0.0 Subsystem Communication
3.1.0 Network Controllers and Hardware
3.1.1 Protocols
3.1.2 Network Configurations
3.1.3 Topology and Controllers
3.1.4 Intersystem Connections
3.2.0 Addresses, Managed Services, and Components
3.2.1 Physical Address
3.2.2 Logical Address
3.2.3 Managed Services
3.2.4 Network Hubs
3.2.5 Network Switches
3.2.6 Router
3.2.7 Virtual Local Area Network (VLAN)
3.2.8 Quality of Service (QoS) and Transmission Algorithm H.323
3.2.9 Wireless Networking (IEEE 802.11)
3.2.10 Unicast, Multicast, and Broadcast
4.0.0 User Interface and Systems Programming
4.1.0 Systems Programming and Interface Design
4.1.1 Systems Controllers
4.1.2 Development Tools
4.1.3 Graphical User Interface (GUI) Development Tools
4.1.4 Other Specialized Development Tools
4.1.5 Systems Controller Advancements
4.1.6 External Computer as Systems Controller
4.1.7 Interface Design
4.2.0 Business Continuity
4.2.1 Fault Tolerance
5.0.0 Residential and Commercial Applications
5.1.0 Residential Applications
5.1.1 Smart Home Integrations
5.2.0 Commercial Building Applications
5.2.1 Systems Normally Combined
5.2.2 The Future of Residential and Commercial Networks

Final Lab Schedule

1. Active Discussion of Fire Alarm System Components and Applications
2. Active Discussion of Nurse Call System Components and Applications

3. Active Discussion of Residential and Commercial Network Systems
4. Final Review (Modules 33406, 33408, 33409)
5. Final Exam

What to bring:

1. Notepad
2. Pens or pencils
3. Electronic Systems Technician: Level 4 Textbook Edition 4
4. 2020 Edition NFPA 70, the National Electric Code (if possible)
5. 2019 Edition NFPA 72, the National Fire Alarm Code, without the California Amendments (if possible)