



Content  
Community  
Connection

United States  
The Electricity Forum Inc.  
742 Pre Emption Road  
Geneva, NY 14456  
Tel 289-387-1025

Canada  
The Electricity Forum  
1885 Clements Rd, Unit 218  
Pickering, ON L1W3V4  
Tel 905-686-1040  
Fax 905-686-1078  
Toll Free 855-824-6131

# 30 Hour Electrical Power System Training - Power System Fundamentals, Short Circuit Study & Device Coordination, Arc Flash Analysis

Course details: <https://electricityforum.com/electrical-training/electrical-power-system-training>

## COURSE DATES AND TIMES

- October 18 2024

- October 21-22 2024

- October 28-29 2024

10:00 am - 4:30 pm ET

Our 30-hour Electrical Power System training course is actually three separate courses: Power System Fundamentals, Short Circuit Analysis & Protective Device Coordination, and Arc Flash Analysis/Study. The three courses together are designed to help both junior and experienced electrical engineers understand electrical power systems as they apply to industrial, commercial and institutional buildings and facilities. NOTE: Course Includes FULL Demo Power System Analysis Software License.

**Electrical Power System Training - Our 5 day (30 hours) live online instructor-led course is actually a series of three courses:**

1. [Power System Fundamentals](#) - October 18, 2024
2. [Short Circuit Analysis & Protective Device Coordination](#) - October 21-22, 2024
3. [Arc Flash Analysis/Study - IEEE 1584 Update](#) - October 28-29, 2024

**Course #1 - Power System Fundamentals - (Price: \$349)**

<https://www.electricityforum.com/electrical-training/power-system-fundamentals>

Our 6-hour (1 Day) Power System Fundamentals course starts with sound design. A proper functioning electric power distribution system is vital to safety, maintenance, troubleshooting and the efficient operation of a modern industrial plant. The power distribution system includes high voltage utility tie circuit breakers, main transformers, medium voltage switchgear, distribution transformers, motor control centers, electric motors, variable speed drives, etc. This course is designed to address all aspects of industrial power distribution systems, including system planning, equipment selection, specification and application, system grounding, protection and conformity with electrical code requirements, etc. Typical one-line and relaying diagrams will be discussed for various applications.

### **Course #2 - Short Circuit Analysis & Protective Device Coordination - (Price: \$599)**

<https://www.electricityforum.com/electrical-training/short-circuit-study-training>

Our 12-Hour (2 Day) Short Circuit Analysis & Protective Device Coordination course will provide a practical and comprehensive description of the principles and concepts of analysis, application and operation of protection schemes for various power system elements such as feeders, transformers, motors, buses, generators, etc. The Power Systems Coordination course makes extensive use of in-class curve drawing exercises and actual case histories to familiarize trainees with the art of power systems coordination. Selection of time/current characteristics, protection, selectivity and deriving protective device settings consistent with National Electric Code and ANSI Standard requirements are emphasized in this course. This course covers the subject of power system protection from a practical perspective, and includes important functional aspects such as testing and coordination of protection systems. This course is designed for individuals who are involved with industries and utilities which depend on proper system protection for operational efficiency and minimizing damage to equipment.

### **Course #3 - Arc Flash Analysis/Study - IEEE 1584 Update - (Price: \$599)**

<https://www.electricityforum.com/electrical-training/arc-flash-analysis-training>

Arc Flash Analysis and Study is the focus of this 12-hour (2 Day) live online training course. First, you will learn to identify requirements and responsibilities from safety standards and codes (CSA Z462, NFPA 70e, IEEE 1584, NESC 410A). Next, you will examine methods for identifying and calculating arc flash hazards. Finally, we will analyze equipment selection and operational strategies to reduce risks.

These three Electrical Engineering Courses will demonstrate electrical engineering software Simulation and Calculations engineering course will provide students with an in-depth review of fault analysis problems in industrial, commercial and institutional power systems and provide the means for solving such problems, and discusses the impact of short-circuit fault currents on equipment selection.

Complete Course Details Here: (Bundle Price: \$1199)

<https://www.electricityforum.com/electrical-training/electrical-power-system-training>

### **WHO SHOULD ATTEND**

Our 30-Hour Power System Fundamentals, Short Circuit Analysis & Protective Device Coordination and Arc Flash Analysis/Study course is designed for utility, industrial, commercial and institutional power system electrical engineering personnel, electrical consulting engineers, as well as electrical design engineers, who are responsible for the

reliable design, engineering and operation and of industrial, commercial and insitutional electric power distribution systems. Plant, facility, and corporate electrical engineers dealing with one or more company distribution systems and consulting and utility engineers dealing with clients' systems. Consultants, architect-engineers will also find this course very beneficial.

### **STUDENTS RECEIVE**

- This Course Includes Our Latest Electrical Electrical Protection and Arc Flash Safety Handbooks!! (Value \$20)
- **\$100 Coupon** Toward Any Future Electricity Forum Event (Restrictions Apply)
- 3.0 Continuing Education Unit (CEU) Credits (30 Professional Development Hours)
- **FREE** Magazine Subscription (Value \$50.00)

### **COURSE OUTLINE**

#### **Course #1 - Power System Fundamentals Live Online Training Course Outline**

##### **DAY ONE**

##### **Introduction to Industrial and Commercial Power Systems**

- Elements Of Industrial Power Systems
- Typical Industrial Power Systems
- Time Domain Versus Frequency Domain
- Effects Of Frequency And Complex Impedances
- Single Phase Power Loads
- Three Phase Power Loads
- Balanced Delta-Connected Loads And Balanced Wye Connected Loads
- Unbalanced Delta-Connected Loads And Unbalanced Wye Connected Loads

##### **Elements of Industrial Power System**

- Standards And Codes
- One Line Diagram Characteristics And Purposes
- System Design Considerations:
  - Safety
  - Reliability
  - Flexibility
  - Voltage Considerations

##### **Equipment Selection:**

- Substation Transformers
- Switchgears & Circuit Breakers
- Fuses & Fuse Disconnects
- Power Distribution Centers
- Motor Control Centers

##### **Power Substation Configuration**

- Functions Of A Substation
- Simple Radial And Expanded Radial System

- Loop Systems
- Selective Systems

### **Voltage Considerations**

- System Voltage Classes
- System Voltage Terminology
- Transformer Connections
- Effects Of Voltage Variations
- Motor Voltage Unbalance

### **Power factor considerations**

- Power Flow Fundamentals
- Leading And Lagging Power Factors
- Typical Plant Power Factor
- Induction Motor Characteristics
- Power Factor Correction Sources
- Benefits Of PF Improvements
- Utility Power Costs
- Release Of Power System Capacity
- Voltage Improvement
- Techniques To Improve PF
- Capacitor Bank Locations
- Capacitor Bank Concerns
- Capacitors And Resonance Issues
- Capacitor Rating
- Power Factor Calculations
- Power Triangles And Calculations Procedures

### **Grounding**

- Types Of System Grounding
- Selection Of System Grounding
- Ungrounded System
- Solidly Grounded System
- High Resistance Grounding
- Impact Of System Grounding
- Equipment Grounding

### **Application of power system Analysis**

- Why A Study?
- Most Common System Studies
- Load Flow Studies
- Short Circuit Study
- Coordination Study
- Arc Flash Study
- Harmonic Problems And Solutions
- Sources Of Harmonic Currents And Voltages
- Resonance Conditions
- Effects Of Harmonics
- Harmonic Analysis

## **Course #2 - Short Circuit Study & Protective Device Coordination**

### **DAY ONE**

- Short Circuit Theory And Analysis
- Effect Of Short Circuit, Arcing And Burning
- Fault Current Sources
- Utility System, Motor And Generators
- Fault Current Types And Characteristics
- Symmetrical Versus Asymmetrical Fault Currents
- AC And DC Decrements
- Fault Calculations, Impedance Modelling
- Balanced Faults And Unbalanced Fault
- Symmetrical Components

### **Balanced Fault Calculations**

- Ohmic Model
- Percent Model
- Per-Unit Model
- Select And Calculate Base Values
- Data Collection And Modelling
- Data Requirements
- Utility Short Circuit Currents And X/R Ratio
- Fault Calculation Procedure
- Per-Unit Impedance Calculations
- Complex Impedance Diagrams
- Machine Reactance Modelling
- Thevenin Equivalent Networks
- Infinite Bus Calculations
- Exercise – Per Unit Modelling
- Typical Industrial Power Systems Modelling Using EasyPower Software

### **Electrical Equipment Ratings:**

- Switchgear Rating And Selection Criteria
- Protective Device Interrupting Ratings
- Equipment Components Withstand Ratings
- Low Voltage Fuse And Circuit Breakers Rating And Selection
- Medium Voltage Power Circuit Breaker And Power Fuses Rating And Selection
- Load Interrupters
- Busway And Conductors
- Equipment Duty Calculations
- Fully Rated Systems
- Low Voltage Series Rated Equipment
- Sample Calculations

### **Transformer Protection**

- Need For Protection
- Types Of Transformers
- Transformer Data
- Causes Of Transformer Overheating
- Transformer Primary Protective Device

- Transformer Through-Fault Capability
- Factors Affecting Transformer Protection
- Basic Transformer Protection
- NEC And CEC Requirements
- Coordination Criteria

## **DAY TWO**

### **Generator Protection**

- Generator Protection Introduction
- Classification Of Generator Applications
- Generator Decrement Characteristics
- Short-Circuit Performance
- Generator Protective Device

### **Conductor and Bus Protection:**

- General Consideration
- Cable Protection
- Short-Circuit Current Protection Of Cables
- Overload Protection Of Cables
- Physical Protection Of Cables
- Code Requirements For Protection Of Cables
- Busway Protection

### **Motor Protection**

- Factors To Consider In Protection Of Motors
- Types Of Protection
- Overcurrent Protection
- Low-Voltage Motor Protection
- Low Voltage Motor Ground-Fault Protection
- Medium-Voltage Motor Protection
- Application Of Stator Winding Temperature Protection

### **Overcurrent Coordination Fundamentals:**

- Overcurrent Protection General Consideration
- Overcurrent Protection Guidelines
- TCC Plots
- CTIs
- Data Collection For Coordination Study
- Phase Coordination
- Ground-Fault Coordination
- Ground-Fault Protective Schemes

### **Fuse Characteristics:**

- Low Voltage Fuses
- Power Fuses
- TCC Curves
- Fuse Coordination Criteria

- Current-Limiting Characteristics
- Application Of Low-Voltage Fuses

### **LV Circuit Breaker Characteristics:**

- Molded Case Circuit Breakers (MCCBs)
- Low Voltage Power Circuit Breakers
- Time Current Curves (TCC)
- Coordination Criteria

### **Time overcurrent relays**

- Introduction
- Electromechanical Relays
- Relay Characteristics
- Solid State Relays
- CTIs

### **Exercise:**

### **EasyPower System Modelling Exercise**

### **Course #3 - Arc Flash Analysis/Study - IEEE 1584 Update**

### **DAY ONE**

#### **1. An Overview of Fault Current Analysis**

- Fault Current Sources
- Short Circuit Current Parameters
- Actual Fault Types
- Balanced Fault Analysis
- Impedance Diagrams
- Fault Current Calculations

#### **2. Overcurrent Coordination Fundamentals:**

- Overcurrent Protection General Consideration
- Protection Guidelines
- TCC Plots
- CTIs

#### **3. Fuse Characteristics:**

- Low Voltage Fuses
- Power Fuses
- TCC Curves
- Fuse Coordination Criteria

#### **4. LV Circuit Breaker Characteristics:**

- Molded Case Circuit Breakers (MCCBs)
- Low Voltage Power Circuit Breakers
- TCC Curves
- Coordination Criteria

## **5. An Introduction to Arc Flash Calculations**

- Arc Flash Analysis
- Causes Of Electrical Flash Events
- Why Perform Arc Flash Studies? Who Should Perform Them?
- CSA Z462/NFPA 70ENF
- IEEE Standard 1584
- Fault Magnitudes
- Overcurrent Device Responses

## **6. Major Changes in IEEE 1584-2018**

- Electrode Configurations
- Typical Working Distance
- Classes Of Equipment And Typical Gap
- Transformer Exception At 240V

## **DAY TWO**

### **7. Calculation Methodology**

- Overview Of Protective Device Coordination
- Understanding Time-Current Curves
- Fault Current Vs. Energy Released
- Calculating With Uncertainty
- Protective Device Trip Time

### **8. Data Collection Process**

- How To Improve Outcomes
- Data Collection Activities & Skill Sets
- Obstacles In Data Collection
- Required Equipment/Device Information
- Understanding Short-Circuit Ratings

### **9. Arc Flash Calculations Continued**

- Accumulated Energy
- Minimum And Maximum Faults
- Use Of Tolerances
- Current-Limited Devices
- System Modes Of Operation
- Calculating Arcing Current
- Determine Of Arc Duration
- Calculate The Incident Energy
- Arc-Flash Boundary Calculations

### **10. Mitigating Risk of Arc Flash Hazards**

- Clearly Understanding Risk Vs Hazard
- Overview Of Electrical Equipment
- How To Reduce Arc Flash Levels
- Fuse-Protected Vs. Non-Fuse-Protected Circuit Breakers
- Arc-Resistant Switchgear
- Arc Flash Label Issues



- Safety: The Overriding Concern

**Exercise:**

Arc flash Analysis using EasyPower Software

**COURSE SCHEDULE:**

**All days:**

Start: 10 a.m. Eastern Time

Finish: 4:30 p.m. Eastern Time

Contact us Today for a FREE quotation to deliver this course at your company's location.

<https://electricityforum.com/onsite-requestforquote>