brainfiller®

Your International Source for
Electrical Power Training

Power System Engineering Course

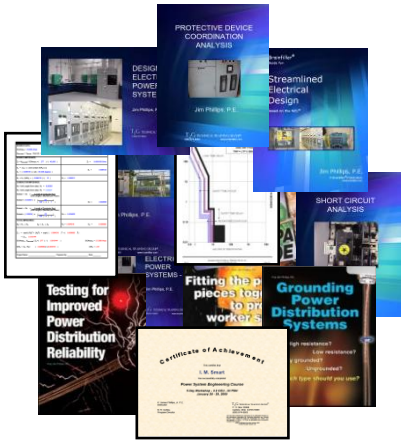
Comprised of Five of Jim's Most Popular Courses

3.2 CEUs

This course by Jim Phillips, P.E. has become the **industry standard** that defines the "Crash Course" in electrical power systems. People from all over the world have attended this week long program that combines five of Jim's most popular classes including Power System Design 1 & 2, Short Circuit and Coordination Studies and Harmonics. He has developed this course based on almost 30 years of extensive experience with industrial, commercial and utility power systems. Even instructors from other training companies have attended Jim's classes to see how it's done. You will learn power system design as well as conduct a short circuit and coordination study and design harmonic filters.

What you *WILL* receive:

- 5 training manuals containing almost 500 pages
- Jim's short circuit calculation worksheets
- Harmonic analysis and design worksheets
- Technical articles
- Many calculation examples and problems
- 32 hours of Continuing Education Credit



What you ***WILL NOT*** receive:

- A commercial to sell you products or equipment
- A sales pitch to sell engineering study services
- A class that is just an overview or teaser

What is so special about Jim Phillips' Power System Class?

Jim is not only one of the most popular and sought after instructors in the industry, he is also directly involved with the development of industry standards and practices. He is a member of the IEEE working group that develops *IEEE Std. 1584* [tm], *IEEE Guide for Performing Arc Flash Hazard Calculations*. With a career spanning 30 years and having taught over 2000 training programs to people from all seven continents, Jim draws from his vast experience in the industrial, commercial and utility fields.

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Course Agenda
Power System Engineering Course

COURSE 1 – POWER SYSTEM DESIGN - I

INTRODUCTION
Electrical Safety, Codes and Standards, Economics

TYPES OF SYSTEMS
Radial, Network, Double Ended Substation, Loop System

VOLTAGE SELECTION
120/240V, 208Y/120V, 480Y/277V, Medium Voltage Selection, Delta vs. Wye, Voltage Drop Calculations

LOAD CALCULATIONS
Lighting and Appliance Loads, Receptacles, Code Calculations, VA per Square ft., Continuous vs. Non-Continuous, Demand Factors, Panel Schedules

CONDUCTORS
Conductor and Conduit Sizing, Insulation Type, Correction Factors, Neutral and Ground Conductors

PANELBOARDS
Power Panels, Lighting and Appliance, Sizing and Ratings

SWITCHBOARDS
Bus Ratings, Breakers, Bus Bracing, AIC, Layout, Series Ratings, Bus Structure, 6 Disconnect Rule

LIGHTING DESIGN
Zonal Cavity Lighting Calculations, Lighting Layout

CASE PROBLEM
Switchboard Circuit Design

COURSE 2 - POWER SYSTEM DESIGN - II

TRANSFORMERS
Types of Transformers, Characteristics and Specifications, K Factor, Protection Based on NEC® 450, Inrush Current

MOTOR CIRCUITS
Locked Rotor and Overload Protection, Insulation Class / Service Factor, Motor Tables, Sizing of Feeders, Protection

Course Agenda
Power System Engineering Course

GROUNDING
Grounding Electrode System, Equipment Ground, Conductor Selection, Separately Derived Systems, High Resistance, Ground, Ground Loops and Power Quality

HAZARDOUS LOCATIONS
Class I, II, and III, Divisions and Groups, Explosion Proof

LIGHTNING PROTECTION
Concept of Protection, Air Terminals, Conductors, NFPA 780

GENERATORS
Emergency Vs. Standby, Selection of Unit, Gasoline, Gas (LP/Natural), Diesel Driven, Design Factors, Loads

AUTOMATIC TRANSFER SWITCHES
Size and Ratings, 3 Pole vs. 4 Pole, Protection of the ATS

UNINTERRUPTIBLE POWER SUPPLIES
UPS Operation, Heat Loss, Compatibility with Generators

CASE PROBLEM
Designing a Transformer Circuit

COURSE 3 - SHORT CIRCUIT ANALYSIS

SHORT CIRCUIT CALCULATIONS
Short Circuit Study Requirements, Conductor Impedance, Source Impedance, X/R Ratio, Conductor Calculations

TRANSFORMER CALCULATIONS
Transformer Impedance, Transformer Calculations, Source Impedance, Transformer Testing, Infinite Bus Calculations

MOTOR CONTRIBUTION
Theory of Motor Contribution, Sub Transient Reactance, Xd'', Effect on Short Circuit Current, Multipliers for SCAm

DEVICE INTERRUPTING RATINGS
Circuit Breaker and Fuse Interrupting Ratings, Testing Methods, Effect of X/R Ratio on Interrupting Ratings

Course Agenda
Power System Engineering Course

SERIES RATINGS
Proper Application of Series Ratings, Fully Rated vs. Series Rated, Current Limitation, Let Thru Current, U.L. Tests

CASE PROBLEM
Short Circuit Study of Small Industrial System

COURSE 4 - COORDINATION STUDIES

COORDINATION STUDY REQUIREMENTS
Selective Coordination Basics, Time Current Curves, Data Requirements, Device Settings, Graph Scale Selection

COORDINATION OF DEVICES
Molded Case Circuit Breaker Coordination, Adjustable Instantaneous Settings, Coordination of Multiple Devices

SOLID STATE / ELECTRONIC TRIP BREAKERS
Long Time, Short Time, Instantaneous Settings, I^2T Settings, Coordination, Eliminating Instantaneous for Coordination

GROUND FAULT RELAYS
Residually Connected Schemes, Zero Sequence Relaying, Settings, Nuisance Tripping, NEC® Requirements, Settings

OVERCURRENT RELAYS
Amp Tap, Time Dial, Instantaneous, Current Transformers, Time Margins, Setting Selection, Time Current Curves

TRANSFORMER PROTECTION
NEC Requirements, Inrush, ANSI C57 Thru Fault Curves, Adjustments to Thru Fault Curves Based on Winding Configurations, Setting Devices for ANSI Protection

CASE PROBLEM
Coordination Study of Small Industrial Plant

COURSE 5 - HARMONIC ANALYSIS

POWER FACTOR CORRECTION
kW, kVA, kvar, PF Concepts. Leading and Lagging, Current Flow, Inductive Loads, Vector Analysis

Course Agenda
Power System Engineering Course

POWER FACTOR CALCULATIONS
Determining Var Requirements, Sizing the Capacitor, Determining Number of Switching Steps and Location

UTILITY RATE STRUCTURE
Utility Rate Structure, Peak Demand, Demand and Power Factor Based Rates, “Creative” Rates after Deregulation

HARMONICS
Concept of Harmonics, Harmonic Spectrum, Sources of Harmonics, Non-Linear Loads, Harmonic Current Flow

HARMONIC RELATED PROBLEMS
Capacitor Failure, Fuse Interruptions, Equipment Heating, Breaker Mis-Operation, Metering Errors, Transformers

RESONANCE
Determining Parallel and Series Resonance, Effect of Source Impedance, Effect of Capacitor Size, Effects of Resonance on the System, Impedance vs. Frequency Scans

IEEE 519
Voltage and Current Distortion Limits, Point of Common Coupling, Enforcement, $I_{harmonic}$ / I_{load} Factor

THIRD HARMONICS
Switched Mode Power Supplies, 3rd Harmonics and Neutrals, Over sizing Neutrals, The use of Delta-Wye K-Factor Transformers, Shared Neutrals, Design Requirements

EVALUATING HARMONICS
Resonance Calculations, THD Calculations, Effect of Parallel Resonance on THD, Effect of Source Strength, Load Types

CORRECTION OF HARMONIC PROBLEMS
Operating Restrictions, Over sizing Neutrals, Harmonic Filter Design, Detuning Capacitor Banks

CASE PROBLEM
Design of a 5th Harmonic Filter Tuned to the 4.7^{th}

FINAL DISCUSSION

ADJURN

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Attend this class and see how to:

- Design electrical power systems more efficiently
- Select and size power system components
- Conduct short circuit studies
- Perform coordination studies
- Calculate overcurrent device settings
- Evaluate harmonics and design harmonic filters
- Understand power system design and analysis

Receive answers to these questions and more:

- How do I select conductors for loads?
- What are demand factors?
- Why is there more to design than the NEC®?
- Why do I contact the electric utility early in the project?
- What questions do I ask the utility company?
- What does voltage drop do to my sensitive loads?
- Why are harmonics and generators not always compatible?
- Why is ANSI C57 a better protection method for transformers than the NEC®?
- What is the X/R ratio?
- How does the X/R ratio effect a device's interrupting rating?
- What is motor contribution?
- How do I calculate motor contribution on new systems with an undefined load?
- Is a 150 degree C rise or 80 degree C rise better for transformers?
- Is a short circuit study legally required?
- What kind of data is required for the short circuit and coordination studies?
- What if I can't find all of the data, what assumptions can I make?
- Why is the *L/E ratio* ™ so important?
- How do you draw time-current curves?
- How do you selectively coordinate overcurrent devices?
- How do current limiting fuses operate?
- How do you determine circuit breaker settings?
- What are the amp tap, time dial and instantaneous settings on a relay?
- What is a symmetrical current vs. asymmetrical current?
- What logic should be used for determining device settings?
- How do I properly apply series ratings?
- What are harmonics and do I need to worry about them?
- How can I predict if harmonics will cause a problem?
- How do I interpret IEEE 519 and what is the point of common coupling?
- Why do I sometimes need to oversize neutrals for 3rd harmonics but not others?
- When and how do I design a harmonic filter

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On Site Training
Have This Course at Your Location!
Hold this class at your location for a greater savings. For an all inclusive fee you receive the following for each attendee:

What you *WILL* receive:

- 5 training manuals containing almost 500 pages
- Jim's short circuit calculation worksheets
- Harmonic analysis and design worksheets
- Technical articles and handouts
- Jim's 35 page Streamlined Design Guide
- Many calculation examples and problems
- 32 hours of Continuing Education Credit

Call Brenda at 800-874-8883 or e-mail at: brenda@brainfiller.com for an On-Site Training Proposal!

Plan Ahead - Jim's schedule usually fills up months in advance!

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Jim Phillips, P.E.

Member of IEEE 1584 *IEEE Guide for Performing Arc Flash Hazard Calculations*

Vice - Chairman of Task Group - *IEEE 1584.1 Guide for the specification of scope and deliverable requirements for an arc-flash hazard calculation.*

Member of IEC 61482-1-2 Determination of arc protection class of material and clothing by using a constrained and directed arc (box test)

Author of the book: *Complete Guide to Arc Flash Hazard Calculation Studies*

Is a regular contributor to Electrical Contractor

Founder of the internationally known website: www.ArcFlashForum.com

For 30 years, Jim has been helping tens of thousands of people around the world understand electrical power systems design, safety, theory and applications. Having taught over 2000 seminars during his career to people from all seven continents (Yes Antarctica is included!), he has developed a reputation for being one of the best trainers and public speakers in the industry.

Jim does not just talk about arc flash and electrical safety - he is part of the development of the arc flash standards! He is also the instructor that has taught other instructors in the industry. Jim is a member of the IEEE 1584 Committee - *IEEE Guide for Performing Arc Flash Hazard Calculations.* He is Vice-Chairman of the IEEE Task Group - IEEE 1584.1 "Guide for the specification of scope and deliverable requirements for an arc-flash hazard calculation study in accordance with IEEE 1584"

Jim literally wrote the book about arc flash studies with his book titled: ***Complete Guide to Arc Flash Hazard Calculation Studies*** available from brainfiller.com and Amazon.com He also wrote "How to Perform an Arc Flash Study in 12 Steps" published by NFPA.

In addition to being a regular contributor to Electrical Contractor Magazine, he was one of the main contributors for the NEC Digest. He has authored many articles published in Europe and is a regular speaker at conferences around the world.

Jim earned a BS Degree in Electrical Engineering from the Ohio State University. His career began with Square D Company's Power System Analysis Group where he was responsible for system studies, power system software development and training at their engineering programs.

Later, Jim was in charge of the studies group of the System Protection Section of Ohio Edison Company. He was part of the adjunct faculty for Stark State College where he taught evening classes in electrical power systems.

Jim is a Registered Professional Engineer. with experience that includes everything from planning transmission systems, to design and analysis of industrial, commercial and utility power systems, cogeneration plant design, expert witness and forensic analysis.

Jim continues to travel the globe typically flying over 150,000 miles a year to work with various U.S. and international standards organizations and speak at many conferences and training events.