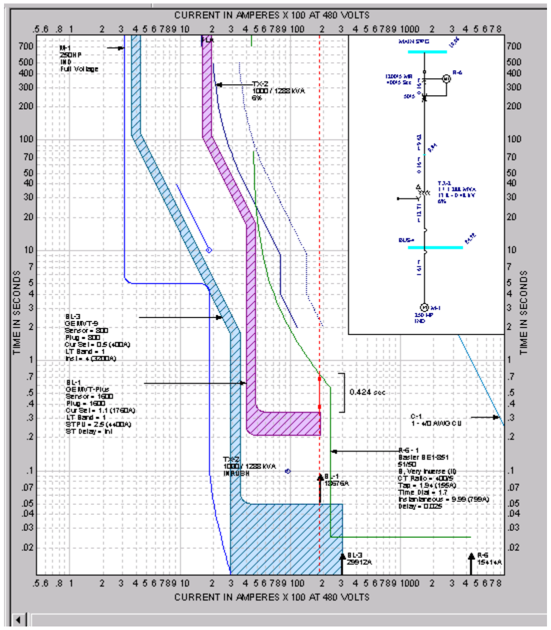
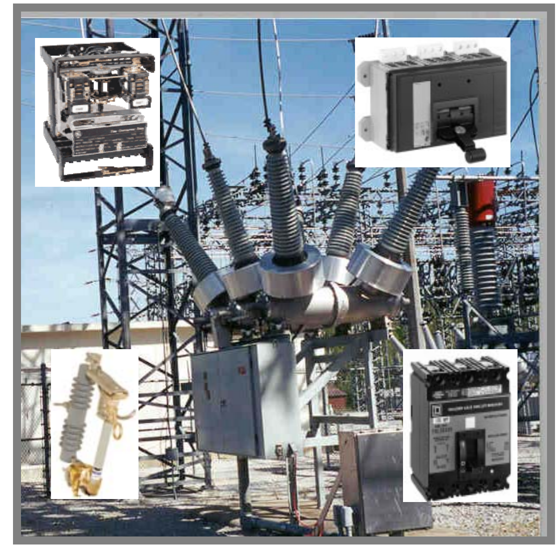
- 4-1/2 day training in the principles and methods used to perform protective device coordination studies for low voltage through distribution level power systems **with or without software**. This is one of the few courses that is not merely a software training course.
- Specifically designed for industrial and government engineers that want knowledge of the principles of protective device coordination but also practical knowledge of *how to achieve reasonable and economical device coordination.*



- Covers concepts, procedures, and guidance not covered in other courses in the industry. Examples will include **critical systems fed from emergency generators and uninterruptible power supplies (UPS).**
- **Student involvement in actual coordination problems** where the instructor will use EasyPower® software to perform the required calculations and to plot the protective device coordination curves. In other words, the students will be able to make the coordination decisions during the process without wasting time learning to push the right button on a computer.
- **A CDROM containing all audio and video of the lecture for days 4 and 5.** This saves note taking on the problem solving session.

Quadrelec Engineering Corp.
4338 S. Jamestown Ave.
Tulsa, OK 74135

Power System Protection and Protective Device Coordination Training



If you are looking for a unique, highly rated, and comprehensive course on basic and advanced principles of protective device coordination for low voltage and distribution voltage systems,……read on.

IEEE

Education Partner

Course Topics

- **System Analysis**
  - Fault Current and Load Flow Calculations Using Computer Software
  - Remote Effects Of Faults
  - Hand calculation method overview
- **Protective Device Coordination Principles**
  - Graphical Tools and Time/Current Curve Interpretation
  - Load Flow and Unbalanced Fault Effects
  - Cold Load Pickup
  - Grounding System Constraints
  - Coordination Economics
  - Asymmetrical Current Impacts
  - Coordination Time Intervals
  - Transformer Effects on Coordination
- **Equipment and Device Characteristics**
  - Fuses - Low Voltage and Medium Voltage
  - Molded case and Insulated Case Breakers
  - Solid-State Trip Low Voltage Breakers
  - Equipment Damage Characteristics
  - Proper Protective Device Selection
  - High Voltage Breakers
  - Low Voltage Cable Protection
  - Shielded Cable Protection
  - Overhead Conductor Protection
  - Motor Protection
  - Generator Protection
  - Transformer Protection
  - Panelboard and Switchgear Protection
  - Inverse Time/Overcurrent Protective Relays and Instantaneous Trip Devices
  - Series Rated Breakers
  - Differential and Voltage Constrained Relays
  - Reclosing relays, reclosers, and sectionalizers
  - Current transformer characteristics and calculations
- **Ground Fault Protection**
  - Arcing Ground Fault Magnitudes
  - Ground Fault Protection Schemes
  - Interaction Of Ground Fault Relays And Phase Overcurrent Devices
- **Emergency Power System Design**
  - Weak Source Systems
  - Generator Fault Characteristics
  - Uninterruptible Power Supply Fault Characteristics
  - Transfer and Static Switch Limitations
  - Improving Emergency Circuit Design
- **Common Coordination Problems, Errors, And Misconceptions**
- **Preliminary System One-line Development for a Coordinated System**
  - Lessons Learned and "Rules of Thumb" to spot uncoordinated systems and *methods to develop a coordinated system design*
- **Criteria Impacting Coordination**
  - NESC, IEEE Std C2,
  - NFPA 70-National Electrical Code
  - **Arc Flash Protection of Employees**
- **Switchgear And Relay Commissioning Including Hands-On Student Calibration Of A Relay**
- **Putting It All Together**
  - 8-11 classroom hours will be used to work example design problems with student involvement in the following system types:
    - Low voltage system with critical systems fed from normal and emergency power sources
    - Medium voltage system from a 15 kV class substation primary to the low voltage secondary.
  - Specification Writing Tips for a Coordinated System
- **Government Criteria** (Optional, for government classes)
  - D.o.D. Unified Facility and FAA Criteria
  - Some classes extend to the fifth day which can be spent covering the government criteria related to protective device coordination

ABOUT THE INSTRUCTOR

Charles Pratt, P.E.

Mr. Pratt has been a practicing professional engineer for over 45 years in this subject. He was an instructor for the U.S. Army Corps of Engineers for 17 years in the subject areas and an engineer for the U.S. Air Force and U.S. Army Corps of Engineers. He is president and principal engineer of Quadrelec Engineering Corporation in Tulsa, OK. His experience in the coordination of power systems and the associated studies span numerous industrial, manufacturing, utility, generation, hospital, and critical military facilities and related load flow and arc flash hazard analyses. Prior to his professional career he was trained by the Oklahoma Gas & Electric Company in the areas of overhead and underground system design and in substation and protective relaying testing and commissioning. As a member of the IEEE Power Engineering and Industrial Applications societies since 1976 and previously trained through Westinghouse and Schweitzer (SEL) industry courses, he brings a wealth of knowledge and practical experience to the course.

ESA

ESA Inc. may be conducting their regional training courses in the same city on use of EasyPower software or other related topics. Learn from the experts, tips and techniques to facilitate your use of EasyPower. See the ESA website for such course offerings at *http://www.easypower.com/support*.

The course is not an EasyPower course use but merely utilizes the unsurpassed characteristics of EasyPower® as a training tool with student involvement.

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COURSE REGISTRATION AND DATES

Check the following websites for course registration, locations and dates. **www.quadrelec.com**

COURSE SUPPLIED MATERIALS

Each student will receive a CDROM containing a copy of government criteria and sample problem files. In addition a copy of the book "A Practical Guide to Short-Circuit Calculations" by Conrad St. Pierre and a complete ring bound set of lecture notes related to over 200 lecture slides will be provided.

REGISTRATION FEE

The registration fee is payable by check, credit card (Master Card and Visa only), government form DD1556, SF82, or company purchase orders. The fee includes course materials, break refreshments, completion certificate, and transcript of CEU or PDH credits.

The cost of the course will be $2.200 per student. (Note: ***A 10% discount is available for IEEE members***. See registration forms at the above website link.)

DAILY SCHEDULE

8:00 AM – 5:00 PM – Days 1 through 3, Lecture
8:00 AM – 5:00 PM Day 4 – Specific Example Problem Exercises (Student Participation in actual coordination problems). Continues Friday morning.

CONTINUING EDUCATION CREDIT

One CEU will be granted for every 10 hours of actual class attendance. A maximum of 3.3 CEUs are available and will be provided by the I.E.E.E. Education Program.

REGISTRATION AND CANCELLATION POLICY

See registration form on the website.

STUDENT SUPPLIED ITEMS

The course has been structured so that ***no computers are needed during classroom lectures***. The course is designed to teach coordination principles and methods rather than computer software usage. Students should bring a hand calculator. All other necessary training materials will be supplied.

Students are encouraged to submit a one-line diagram with the necessary system and protective device data for use during the Thursday and Friday sessions. These systems may be selected as a "study system" for the students analysis. During this all day session, the **students will perform portions of an actual coordination study of the system**. Thus, a side benefit of the course is that you will receive tips on coordination problems within an actual system in your plant or real world examples.