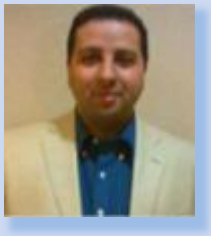
High and Medium Voltage Power System Design and Protection

Practically Enhance Your Knowledge on Power System Design and Significant Skill on Protection

February 8-12, 2016 • Toronto, Ontario (Hampton Inn Mississauga West)



Course Facilitators:

Prof. Eric Stark
Senior Engineering Consultant & Trainer
RNI Technology (Protection)

Highlight

- IEEE senior research & engineering
- A sought after expert and trainer for Protection & Control, Engineering and Project management for 31y.
- Expert knowledge in Protection & Control relays and SCADA

Khaled Akida, MBA, P.Eng., M.Sc.
General Manager
TEEBA Engineering Inc.

- Registered professional engineer with 15+ years expertise in power system studies, substation design
- Field-testing and commissioning, grounding and power quality audits
- Electromagnetic field and interference (EMF/EMI) audits
- Electrical Health and Safety (EHS) programs settings for Oil and Gas, Mining, Electrical Utilities and Industrial Plants.

Proudly Organized by:

TESTIMONIALS

"Eric has deep knowledge and wide experience in power system analysis and protection."
~ Senior Tech. Instructor, ABB OH, USA

"Excellent job was done here. Exactly what I needed."
~ Application Engineer, R&PS

"Eric did a giant job! And get across the information needed and was very helpful and willing to make the class useful for us."
~ Engineer, Protection & Maintenance, Elko, NV. USA

"Very good course, exactly what we needed, a great step up for my team."
~ Head Engineer, IEC

"Very satisfied, excellent course, excellent instructor."
~ Engineer, BC, CA

"Great course, excellent examples and case analysis. It really made a difference for us. Thank you, Eric."
~ Senior Manager, PT GUNAEL ELECTRO, Jakarta, Indonesia

MAJOR BENEFITS OF ATTENDING – YOU WILL:

REFRESH your knowledge of power systems design, planning, analysis, protective device applications, protective relay schemes, and relay coordination for safe and efficient operation of electrical power systems and equipment

DEVELOP your own relay settings and thoroughly understand the philosophy of protective systems

LEARN actual cases illustrating various techniques in present use and highlighting particular approaches used by experienced system designers

ENHANCE your experience with power system protection problems generally faced and solutions successfully adopted by industry

UNDERSTAND how to apply microprocessor-based multi-function relays on protection of various power system equipment and apparatus

GAIN valuable experience from instructors who spent more than three decades of consulting work around the world to various utility and industrial power systems

RNI and TEEBA training courses are thoroughly researched and carefully structured to provide practical and exclusive training applicable to your organization.
Benefits include:
• Thorough and customized programs to address current market concerns
• Illustrations of real life case studies
• Comprehensive course documentation
• Strictly limited numbers

Workshop Overview

Power system protection of various electrical equipment and apparatus requires good understanding of phase and ground short circuit currents, detection, and safe clearing of the faulted equipment. This course is ideal for engineers shifting into the field of protection and control. This program starts with an overview of power system fundamentals, design and short circuit calculations which lead to the understanding of protection scheme requirements and its applications.

Protection requirements for industrial plants, cogeneration, smart grids and interconnection with utility power system are explained in detail. This course covers the subject of power system protection from a practical perspective, and includes important functional specs such as testing and coordination of protection systems. This course is designed for individuals who are involved with industries and utilities to learn how to design and protect personnel and equipment.

WHO SHOULD ATTEND

This training program is uniquely designed to provide valuable insight for:

- ✓ Electrical Power Distribution Engineers
- ✓ Electrical Power System Planners
- ✓ Electrical Power System Engineers
- ✓ Plant and Project Managers
- ✓ Consulting Engineers
- ✓ Electrical Engineers and Technical Staff entering the protection field
- ✓ And any other engineers and technical personnel involved with design, operation, maintenance, testing, and troubleshooting of high and medium voltage electrical systems and equipment.

WHY YOU CANNOT MISS THIS EVENT

Good and optimized design of electric power distribution systems is vital to safety, maintenance, troubleshooting and efficient operation of electrical systems and modern industrial plants. This course is designed to address all aspects of industrial and utility power 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.

Leading trainers and consultants, Eric Stark and Khaled Akida, will be sharing their knowledge and experience of more than 31 years in industry. The training will be presented with a practical approach in mind. The learning will be conducted along with relevant case studies and industry best practices. Delegates will be encouraged to participate and contribute their cases to the discussion.
Delegates will be able to immediately apply the knowledge gained in the workshop to improve coordination and relay setting files and prevent power system protection problems.

DAY 1 | February 8, 2016

OVERVIEW OF ELECTRICAL UTILITY AND INDUSTRIAL

POWER SYSTEMS GRID FUNDAMENTALS

SYSTEM DESIGN CONSIDERATIONS

Safety
Reliability and flexibility
Sensitivity and speed
Voltage considerations

SYSTEM PLANNING

Utility service and requirements
Protection consideration
Special loads

POWER SYSTEM CONFIGURATION

EQUIPMENT SELECTION

Circuit breakers
Buses
Voltage transformers
Current transformers
Relays and protection schemes

POWER SYSTEM ANALYSIS

SHORT CIRCUIT CALCULATIONS

Effects of short circuit
Sources of fault currents
System modeling
Limiting short circuit currents

SEQUENCE CURRENT COMPONENTS IN PROTECTION

POWER FLOW ANALYSIS AND RELAYING

PRINCIPLES OF POWER SYSTEM PROTECTION

GROUND FAULT PROTECTION

System grounding methods
Zero-sequence currents
Ground fault concerns

HIGH VOLTAGE DIFFERENTIAL PROTECTION RELAYING

Line modeling
Ferranti effect on end-of-line
Charging currents
Primary and secondary values

EQUIPMENT SELECTION

SYNCHROPHASORS HOLISTIC GRID PROTECTION

DAY 2 | **February 9, 2016**

FEEDER PROTECTION

Fuse characteristics Time-
current coordination curves
Relay-fuse-relay TOC, IOC selectivity and coordination
Main-Tie-Main transfer schemes
Radial systems, loop systems, selective systems

BUS PROTECTION

Principles
Topologies
Protection schemes
Hi-Ampacity current detection
Hi and Low impedance relaying
Bus-Feeder inter-relations

TRANSFORMER PROTECTION

Substations components
Protection philosophies
Protection elements
Ground fault protection
Neutral grounding systems

DAY 3 | **February 10, 2016**

TRANSMISSION LINE PROTECTION

Line protection
Line differential communication
Distance protection relaying
Non-pilot schemes
Pilot wire and schemes

MOTOR PROTECTION

Motor nameplates
Thermal overload protection
Thermal capacity relaying
Acceleration limits
Phase and ground fault protection
Protection elements
Setting considerations

GENERATOR PROTECTION

Radial and loop systems
Multi source systems
Protection main elements
Phase and ground fault protection
Standby generation protection
Backup protection relaying
Volt per Hertz - under / over voltage and frequency

Case study:

- Motor loading and protection calculation and protection relay inputs discussion.

Case study:

- Microgrid loading, balancing and co-ordination and load shedding discussion.

Program Schedule

(Day 1 - Day 5)

08:30	Registration
09:00	Morning Session Begins
10:30 - 10:45	Refreshments & Networking Break
12:00	Lunch break
13:00	Afternoon Session begins
14:30 - 14:45	Refreshments & Networking Break
16:30	Day Ends

In-House Training

Cost effective In-house courses, tailored specifically to your organization's needs, can be arranged at your preferred location and time. If you would like to discuss further, please contact our In-house division at eric@rnitechnology.com.

PRE-COURSE QUESTIONNAIRE

To ensure that you gain maximum value from this course, a detailed questionnaire will be forwarded to you upon registration to establish your exact training needs and issues of concern. Your completed questionnaire will be analyzed by the course trainer prior to the event and addressed during the event. You will receive a comprehensive set of course documentation to enable you to digest the subject matter in your own time.

DAY 4 | **February 11, 2016**

POWER QUALITY

Power quality main definitions
Types and sources of power disturbances
Harmonics and its impacts
Effects of power quality on equipment
Equipment to improve power quality
Utility role in providing power quality

HIGH VOLTAGE SUBSTATION DESIGN AND PROTECTION

Grounding Fundamentals
Grounding and step / touch potentials
Electrical apparatus layout
Ground Potential Rise
Zone of influence
Pea asymmetrical voltage level
Special HV protection
Uncoated and plastic coated cables
Fiber Optic System
Soil resistivity calculations
Ground grid resistance calculations
Grounding Design
Grounding Commissioning

DAY 5 | **February 12, 2016**

SAFETY BY DESIGN

Arcing faults
Arc Flash impacts
NFPA 70E and CSA Z462 applications
Grounding
Bus Consideration
Relaying Solutions

SMART GRID PROTECTION

Distributed generation (DG)
IEEE Std. 1547 overview
Interconnection protection
Challenges of a protection engineer
Utility interconnection protection requirements
Transformers configuration for interconnection
DG interconnection protection

US-CANADA Blackout Case Study

Power System reliability and interconnection
Power System Stability
Pre-outage conditions on August 14, 2003
Trigger events and start of cascade
Wide area cascade
Root causes of blackout and takeaways

***Registration** Easy 1-2-3:*

1. Email to: RNITECH@GMAIL.COM
2. Registration fee of $220* will guarantee your spot, and is part of the course fee by Visa or MasterCard, paid online:

   http://www.rnitechnology.com/Upcoming_Toronto.php
3. The balance of $1980 can be paid by Feb.-04 by Visa or MasterCard, or at the door by a bank certified check.

   http://www.rnitechnology.com/Upcoming_Toronto.php

✓ Early bird registration (before Jan.-04) and a group of 3+ from the same company are entitled to a discounted balance of $1780.

✓ Fee includes **hot** breakfast and lunch.

* Registration/Admin fee is non-refundable.

ABOUT YOUR COURSE FACILITATORS

Eric Stark is a Senior Trainer and Consultant of RNItechnology (www.RNItechnology.com). He has more than 31 years of consulting and training experience and practice in industrial applications, utilities and academics in North America and around the world.

Eric has extensive experience in power system design, protection and commissioning. Special emphasis on protection, power systems co-ordination, quality, power system grounding, power flow, short circuit, arc flash, transient stability, transient switching analysis and harmonic studies.

Eric's recent work included several generation, micro-grid, subway and utility projects in North America and Middle East, including system and stability studies. Eric was involved in protective relay settings, transfer schemes, co-ordination, and load shedding schemes.

In addition to his vast professional experience, Eric is the co-author of technical papers for major players like General Electric, RCC Institute of Technology, IEC and has prepared and conducted numerous courses, seminars, workshops and tutorials in academics and industry, globally, for GE and RNItechnology clients.

His experience includes industries such as oil and gas, silver, gold and phosphate mining, co-generation, utility systems, pulp and paper, and many application projects.

Khaled Akida, MBA, P.Eng., M.Sc. General Manager of TEEBA Engineering Inc. (www.teebaengineering.com)

A registered professional engineer in Canada (ON and AB) with 15+ years of experience in power system studies, substation design, field-testing and commissioning, grounding and power quality audits, electromagnetic field and interference (EMF/EMI) audits, Electrical Health and Safety (EHS) programs settings for Oil and Gas, Mining, Electrical Utilities and Industrial Plants.

Formerly, an Engineering Manager at GE Canada and Schneider Electric Canada in Ontario, where he managed large engineering projects across North America.

He received his B.Sc. from Ain Shams University, M.Sc. in electrical engineering from the University of New Brunswick (UNB), and MBA from Laurier School of Business (WLU).

Khaled has managed and executed 100+ engineering projects on substation design, field testing, power quality audits and power system studies (short circuit, coordination study, arc flash, load flow, power factor correction, harmonics, dynamic stability, transient motor starting, ground grid testing and design, etc.), EMF/EMI audits and grounding audits, for major electrical utilities, mines, oil and gas, data centers, industrial and commercial facilities in Canada and the USA.

Mr. Akida has various IEEE publications, has served as a technical reviewer in many IEEE journals in power systems and control systems, and was the ex-chair of the Industry Application Chapter (IAS) for IEEE Toronto Section. He remains an active member for the IEEE substation committee of IEEE Std. 81 ground testing (WGE6) and IEEE Std. 80 ground design (WGD7). A certified electrical safety trainer by GE Corporate, Khaled also taught more than 60 technical courses across Canada, USA, Asia and the Middle East from COO level to electrical technical teams in all power systems engineering areas.

Partial List of satisfied clients includes:

- ✓ GE Energy
- ✓ Hydro One
- ✓ Hydro Ottawa
- ✓ Oakville Hydro
- ✓ North Bay Hydro
- ✓ EPCOR
- ✓ BC Hydro
- ✓ IEC Electrical Utility Corp.
- ✓ ATCO
- ✓ RCC Institute of Technology
- ✓ Texas Cheniere Energy
- ✓ Dead Sea Industries
- ✓ Cusco Industries
- ✓ Petronas Oil
- ✓ NYPA Utilities
- ✓ PG&E
- ✓ NWT Utilities
- ✓ Shell Oil
- ✓ Chevron Oil
- ✓ Caterpillar
- ✓ Barrick Gold
- ✓ Oncor utilities
- ✓ GE global numerous client list
- ✓ Millar Western
- ✓ Puerto Rico Power Utilities
- ✓ Lafarge
- ✓ ABB Canada
- ✓ GE Hitachi Canada
- ✓ Plan Group
- ✓ Schneider Electric Canada
- ✓ Siemens Canada
- ✓ N.W. Territories Utilities
- ✓ Consultec