ELECTRICAL GENERATORS & EXCITATION SYSTEMS, PARTIAL DISCHARGE, DIAGNOSTIC TESTING & PROTECTIVE SYSTEMS
Selection, Applications, Operation, Diagnostic Testing, Troubleshooting, Maintenance, and Refurbishment

11 – 15 DECEMBER 2017, KUALA LUMPUR, MALAYSIA

Expert Course Faculty Leader

Philip Kiameh

Has more than 30 years of practical engineering experience with Ontario Power Generation and as a Training Manager, has conduct courses and seminars, to more than 4,000 working engineers and professionals who consistently ranked him as "Excellent" or "Very Good". Philip has also wrote 5 books for working engineers from which three have been published by McGraw-Hill, New York.

Topics Covered

Synchronous Generators,
Generator Stator and Rotor Construction

Generator Components,
Auxiliaries and Excitation

Generator Main Connections, Generator Surveillance and Testing, Advanced Methods for Preventing Partial Discharge, Performance and Operation of Generators

Generator Inspection and Maintenance, Generator Rotor Reliability and Life

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powerEDGE®
Empower your future

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ELECTRICAL GENERATORS & EXCITATION SYSTEMS, PARTIAL DISCHARGE, DIAGNOSTIC TESTING & PROTECTIVE SYSTEMS
11 – 15 DECEMBER 2017, KUALA LUMPUR, MALAYSIA

Introduction

This seminar will provide a comprehensive understanding of the various types of generators, exciters, automatic voltage regulators (AVR’s), and protective systems. This seminar will focus on maximizing the efficiency, reliability, and longevity of this equipment by providing an understanding of the characteristics, selection criteria, common problems and repair techniques, preventive and predictive maintenance. The emphasis in this seminar is on inspection methods, diagnostic testing, troubleshooting, modern maintenance techniques, refurbishment, rewind and upgrade options, and advanced methods for preventing partial discharge and other failures.

This seminar is a MUST for anyone who is involved in the selection, applications, or maintenance of generators, exciters, automatic voltage regulators (AVR’s), and protective systems because it covers how this equipment operates, the latest maintenance techniques, and provides guidelines and rules that ensure the successful operation of this equipment. In addition, this seminar will cover in detail the basic design, operating characteristics, specification, selection criteria, advanced fault detection techniques, critical components and all preventive and predictive maintenance methods in order to increase reliability of the equipment and reduce the operation and maintenance cost.

This seminar will provide the following information for all types of generators, exciters, automatic voltage regulators (AVR’s), and protective systems:

- Basic Design
- Specification
- Selection Criteria
- Sizing Calculations
- Enclosures and Sealing Arrangements
- Codes and Standards
- Common Operational Problems
- All Diagnostics, Troubleshooting, Testing, and Maintenance

Seminar Outcomes

- **Equipment Operation**: Gain a thorough understanding of the operating characteristics of generators, exciters, automatic voltage regulators (AVR’s), and protective systems
- **Equipment Diagnostics and Inspection**: Learn in detail all the diagnostic techniques and inspections required of critical components of generators, exciters, automatic voltage regulators (AVR’s), and protective systems
- **Equipment Testing**: Understand thoroughly all the tests required for the various types of generators, exciters, automatic voltage regulators (AVR’s), and protective systems
- **Equipment Maintenance and Troubleshooting**: Determine all the maintenance and troubleshooting activities required to minimize the downtime and operating cost of generators, exciters, automatic voltage regulators (AVR’s), and protective systems
- **Equipment Repair and Refurbishment**: Gain a detailed understanding of the various methods used to repair and refurbish generators, exciters, automatic voltage regulators (AVR’s), and protective systems
- **Equipment Rewind and Upgrade Options**: Discover all options available to rewind and upgrade the generator rotor and stator to enhance the output and reduce downtime
- **Efficiency, Reliability, and Longevity**: Learn the various methods used to maximize the efficiency, reliability, and longevity of generators, exciters, automatic voltage regulators (AVR’s), and protective systems
- **Advanced Methods to Prevent Failure**: Gain a thorough understanding of all the methods used to prevent partial discharge, and other failures in generators, exciters, automatic voltage regulators (AVR’s), and protective systems
- **Equipment Sizing**: Gain a detailed understanding of all the calculations and sizing techniques used for generators, exciters, automatic voltage regulators (AVR’s), and protective systems

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• **Design Features:** Understand all the design features that improve the efficiency and reliability of generators, exciters, automatic voltage regulators (AVR’s), and protective systems

• **Equipment Selection:** Learn how to select generators, exciters, automatic voltage regulators (AVR’s), and protective systems by using the performance characteristics and selection criteria that you will learn in this seminar

• **Equipment Enclosures and Sealing Methods:** Learn about the various types of enclosures and sealing arrangements used for generators, exciters, automatic voltage regulators (AVR’s), and protective systems

• **Equipment Commissioning:** Understand all the commissioning requirements for generators, exciters, automatic voltage regulators (AVR’s), and protective systems

• **Equipment Codes and Standards:** Learn all the codes and standards applicable for generators, exciters, automatic voltage regulators (AVR’s), and protective systems

• **Equipment Causes and Modes of Failure:** Understand causes and modes of failure of generators, exciters, automatic voltage regulators (AVR’s), and protective systems

• **System Design:** Learn all the requirements for designing different types of generators, exciters, automatic voltage regulators (AVR’s), and protective systems

**Who Should Attend**

• Engineers of all disciplines

• Managers

• Technicians

• Maintenance personnel

• Other technical individuals

**Training Methodology**

The instructor relies on a highly interactive training method to enhance the learning process. This method ensures that all the delegates gain a complete understanding of all the topics covered. The training environment is highly stimulating, challenging, and effective because the participants will learn by case studies which will allow them to apply the material taught to their own organization.

**Special Feature**

Each delegate will receive a copy of the following materials written by the instructor:

2. Generator Inspection, Maintenance and Refurbishment Manual (this manual covers all the inspection and maintenance activities as well as all protective systems required for generators - 300 pages)
Your Expert Faculty

Philip Kiameh, M.A.Sc., B.Eng., D.Eng., P.Eng. (Canada) has been a teacher at University of Toronto and Dalhousie University, Canada for more than 25 years. In addition, Prof Kiameh has taught courses and seminars to more than four thousand working engineers and professionals around the world, specifically Europe and North America. Prof Kiameh has been consistently ranked as "Excellent" or "Very Good" by the delegates who attended his seminars and lectures.

Prof Kiameh wrote 5 books for working engineers from which three have been published by McGraw-Hill, New York. Below is a list of the books authored by Prof Kiameh:

5. Industrial Equipment (600 pages), Custom Publishing, University of Toronto, University of Toronto, University of Toronto Custom Publishing (1999).

Prof. Kiameh has received the following awards:
1. The first "Excellence in Teaching" award offered by Poweredge Pte Ltd Training Center, Singapore, December 2016
2. The first "Excellence in Teaching" award offered by the Professional Development Center at University of Toronto (May, 1996).
3. The "Excellence in Teaching Award" in April 2007 offered by TUV Akademie (TUV Akademie is one of the largest Professional Development centre in world, it is based in Germany and the United Arab Emirates, and provides engineering training to engineers and managers across Europe and the Middle East).
4. Awarded graduation “With Distinction” from Dalhousie University when completed Bachelor of Engineering degree (1983).

Prof. Kiameh performed research on power generation equipment with Atomic Energy of Canada Limited at their Chalk River and Whiteshell Nuclear Research Laboratories. He also has more than 32 years of practical engineering experience with Ontario Power Generation (OPG - formerly, Ontario Hydro - the largest electric utility in North America). Prof. Kiameh retired from OPG in November 2016.

While working at Ontario Hydro, Prof. Kiameh acted as a Training Manager, Engineering Supervisor, System Responsible Engineer and Design Engineer. During the period of time that Prof Kiameh worked as a Field Engineer and Design Engineer, he was responsible for the operation, maintenance, diagnostics, and testing of gas turbines, steam turbines, generators, motors, transformers, inverters, valves, pumps, compressors, instrumentation and control systems. Further, his responsibilities included designing, engineering, diagnosing equipment problems and recommending solutions to repair deficiencies and improve system performance, supervising engineers, setting up preventive maintenance programs, writing Operating and Design Manuals, and commissioning new equipment.

Later, Prof Kiameh worked as the manager of a section dedicated to providing training for the staff at the power stations. The training provided by Prof Kiameh covered in detail the various equipment and systems used in power stations.

Professor Philip Kiameh was awarded his Bachelor of Engineering Degree "with distinction" from Dalhousie University, Halifax, Nova Scotia, Canada. He also received a Master of Applied Science in Engineering (M.A.Sc.) from the University of Ottawa, Canada. He is also a member of the Association of Professional Engineers in the province of Ontario, Canada.
5 Day Course Outline

Day 1 – Synchronous Generators, Generator Stator and Rotor Construction

- Synchronous machines, physical description, pole pitch: electrical degrees, synchronous machine windings, field excitation, rotating rectifier excitation, series excitation, no-load and short-circuit values, torque tests, speed-torque characteristic, excitation of a synchronous machine, machine losses
- Synchronous generators, construction, speed of rotation of a synchronous generator, equivalent circuit of a synchronous generator, power and torque in a synchronous generator, synchronous generator operating alone, parallel operation of ac generators, frequency-power and voltage-reactive power characteristics, synchronous generator ratings, synchronous generator capability curves, short-time operation and service factor
- Generator stator construction, stator windings, stator insulation, forces on stator windings, stator endwinding support structure, generator rotor construction, rotor windings, rotor insulation, retaining rings, rotor endwinding structure

Day 2 – Generator Components, Auxiliaries and Excitation

- Generator components, auxiliaries and excitation, the rotor, rotor windings, rotor end rings, wedges and dampers, sliprings, brushgear and shaft grounding, fans, rotor and threading alignment, vibration, bearings and seals
- The stator, stator core, core frame, stator windings, end winding support, electrical connections and terminals, stator winding cooling components, hydrogen cooling components, stator casing
- Cooling systems, hydrogen cooling, hydrogen cooling systems, shaft seals and seal oil systems, thrust-type seal, journal-type seal, stator winding water cooling systems
- Excitation, AC excitation systems, exciter transient performance, pilot exciter, main exciter, exciter performance testing, pilot exciter protection, brushless excitation systems, rotating armature main exciter
- The voltage regulator, power system stabilizer, characteristics of generator exciter power systems (GEP), generator operation
Day 3 – Generator Main Connections, Generator Surveillance and Testing, Advanced Methods for Preventing Partial Discharge, Performance and Operation of Generators

- Generator main connections, isolated phase bus bar circulatory currents, system description
- Inspection practices and methodology, site preparation, foreign material exclusion, experience and training, safety procedures – electrical clearances, inspection frequency, generator accessibility, inspection tools, inspection forms
- Generator surveillance and testing, generator operational checks (surveillance and monitoring), generator diagnostic testing, insulation resistance and polarization index, dc hipot test, ac Tests for stator windings, synchronous machine rotor windings, partial discharge tests, mechanical tests
- Advanced methods for protecting the generator stator bars from partial discharge, causes of partial discharge, controlling partial discharge using antimony-doped tin oxide filler material, advanced methods for preventing partial discharge in generator stator bars, modern US patents for preventing partial discharge
- Generator systems, condition monitoring, operation limitations, fault conditions
- Dry Seals, Advanced Sealing Mechanisms, and Magnetic Bearings

Day 4 – Generator Inspection and Maintenance, Generator Rotor Reliability and Life Expectancy

- Generator inspection and maintenance, on-load maintenance and monitoring, off-load maintenance, generator testing
- Generator operational problems, and refurbishment options, typical generator operational problems
- Generator rotor reliability and life expectancy, generator rotor refurbishment, generator rotor modifications, upgrades, and uprates

Day 5 – Generator Upgrades and Rewinds, Double Feed Generators, Power Station Electrical Systems and Design Requirements, Power Station Protective Systems, Frequently Asked Questions

- Generator upgrades and rewinds, rewinding for increased reliability, rewinding for increased output or efficiency, stator windings, rotor windings, impact on other components
- Stator windings, slot support system, end winding support, asphalt conversions, emergency situations, complete rewind, partial rewind, repair of bars, stator winding insulation, stator winding quality
- Field rewinds, overall design approach, component design, additional field considerations, field coil slot wedges, retaining rings, collector rings and bore copper, field winding quality, spare rotor
- Other generator equipment and auxiliaries, excitation equipment, removable cartridge brush holders, coolers, control cabinets, babbitted hydrogen seals, generator gas monitoring system and tagging compounds, air gap flux probe, shaft voltage monitor
- Double-feed generators, system configuration, equivalent circuit for the brushless double-fed machine, parameter extraction, generator operation, converter rating, machine control
- Bearings and Lubrication, Types of bearings, ball and roller bearings, thrust bearings, lubrication, viscosity of lubricants, greases, VI improved oils
- Used oil analysis, test description and significance, visual and sensory inspection, chemical and physical tests
- Vibration analysis, resonance, vibration instrumentation, vibration analysis, vibration causes, vibration severity
- Power station electrical systems, and design requirements, system requirements, electrical system description, system performance, unit start-up, synchronization, shutdown and power trip, power plant outages and faults, uninterruptible power supply systems, dc systems
- Power station protective systems, design criteria, generator protection, dc tripping systems
- Frequently asked questions
OTHER AVAILABLE COURSES

4 Pillars of Transformer Condition
Advanced Project Finance for Power
Advanced Technical Report Writing & Presentation Skills
Ancillary Services in Competitive Electricity
Asset Management for the Power Industry
Best Practice Renewable Energy Capital & Project Management
Biomass Power Generation
CFB Combustion for Boiler Operations
Clean Development Mechanism and Carbon Markets
Coal Contracts
Combined Cycle Power Plants Operation
Combined Heat & Power (CHP) and Co-Generation Plant Operations
Design & Operations of Circulating Fluidized Bed Boiler
Developing & Structuring Public-Private Partnership (PPP) for Infrastructure
Effective Tender Process Management for Power & Utilities
Electrical Hazop (eHazop) Studies for the Power Industry
Electricity Demand-Side Management
Electricity Industry Design
Electricity Network Planning
Electricity Retail Contracts
Electricity Theft
Energy Efficiency
EPC Contract Management for Power & Utilities
Essentials of Coal Markets and Trading
Essentials of Power Trading
Excitation Systems
Feed-In Tariffs for PV Systems
Financial Modelling for Project Finance in Power & Utilities
Fitness-For-Service API 579 & High Energy Piping Life Management
Fundamentals of Geothermal Energy
Fundamentals of Power Generation
Gas & LNG Contract Negotiation
Gas Turbine Generator Selection, Operation & Maintenance
Gas Turbine Hot Gas Paths, Rotors & Failure Analysis
Gas Turbine Major Inspection & Overhaul
GE Gas Turbine Operations Simulation Based
HRSG Design, Operations & Understanding, Controlling of HRSG Damage
HV Substation Design & Construction
IEC for Utilities
Integration of Distributed Generation
Introduction to Carbon Capture & Storage
Introduction to Clean Coal Technology
Introduction to Power Systems
Keeping Electrical Switchgear Safe
Leadership & Team Dynamics for Power & Utilities
LNG Fundamentals
LNG Markets & SPOT Trading
Maintenance Planning & Scheduling
Making IPP & Renewable Energy Projects Contract Frameworks Bankable
Managing Complex Projects for Power and Utilities Professionals
Medium Voltage & High Voltage Switchgear
Metallurgy for Engineers
Mechanical Engineering for Non-Mechanical Engineers
Mini Hydro Project Analysis
MKV Speedtronic Control System
MK VI Speedtronic Control System
Nuclear Energy Project Planning & Economics
Nuclear Power
Offshore Platforms Electrical Systems Design & Illustrations
Operations of Coal Fired Power Plants
Power Generation Commissioning, Operations & Maintenance
Power Generation Operation, Protection & Excitation Control
Power Plant Chemistry for Chemist & Chemical Engineers
Power Purchase Agreements
Process Control Methods
Programmatic CDM
Project Management for Power and Utilities
Relay Protection in Power Systems
Reliability Centered Maintenance Masterclass
Reliability Engineering
Renewable Energy Development & Investment
Renewable Energy Integration
Risk Based Inspection
Risk Management in Power Markets
Root Cause Analysis
Rotating Equipment Maintenance & Reliability Excellence
SCADA & Power Systems
Smart Grid
Solar Energy & Photovoltaic Power
Spare Parts Optimisation
Supercritical and Ultra-Supercritical Coal-Fired Power Plant
Technical Report Writing & Presentation Skills for Power & Utilities Professionals
Ultra Low NOx Gas Turbine Combustion
Uninterruptible Power Supply
Vibration Analysis & Condition Monitoring
Waste to Energy Plant Operations
Water Treatment and Corrosion Control for Steam Generation and Power Production
Writing Effective Standard Operating Procedures (SOP) for Power & Utilities Professionals & Engineers

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<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
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<tbody>
<tr>
<td>1. Does PowerEdge have other programmes than those listed?</td>
<td>We have more than 200 programmes that we are capable of running. All we need is for you to contact us and request for the preferred programme and we will able to develop it.</td>
</tr>
<tr>
<td>2. Where is PowerEdge based?</td>
<td>PowerEDGE is headquartered in Singapore but we run our training programmes in different venues around Asia.</td>
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<td>3. What does PowerEdge do?</td>
<td>We are a Power &amp; Utilities Training Specialist.</td>
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<td>4. Can this course be done in our city?</td>
<td>It absolutely can. Get in touch with us to request for a training programme to be carried out in your city.</td>
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<td>5. Can you reduce the price of our preferred course?</td>
<td>While our price has been reduced before it is even launched, we are always happy to help you with further discounts.</td>
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<td>6. Can you change the dates of the course?</td>
<td>If you have a special requested date, let us know and we will arrange another session for you.</td>
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<td>7. Who are the companies that will be participating?</td>
<td>This varies from a diversity of Power Operators, Regulators, Financiers, to Vendors in the Power &amp; Utilities industry.</td>
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<td>8. Where is the venue for the course?</td>
<td>We usually engage a 4 to 5 star hotel meeting room to ensure the comfort of our participants.</td>
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<td>9. How many delegates should we expect for each course?</td>
<td>This varies from 15 to 20 participants. Class sizes are kept small to allow trainers to focus better on each participant.</td>
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<td>10. What are the different payment modes?</td>
<td>We accept Visa/MasterCard, cheques, bank transfers and cash on site.</td>
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<td>11. Is accommodation included when I sign up for a course?</td>
<td>Accommodation is not included in the course fee but we are always happy to advise on available accommodations.</td>
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<td>12. Can I get a cheaper accommodation through PowerEdge?</td>
<td>We will be pleased to help you negotiate a better rate with hotels.</td>
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<td>13. Is lunch provided during the course?</td>
<td>We provide lunch and 2 tea breaks every day during our training programmes.</td>
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<td>14. Are the training materials included once I have signed up for a course?</td>
<td>Yes, training and course materials are included in the course fee.</td>
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<td>15. Will there be a certificate for the course?</td>
<td>Yes, there will be a certificate of participation upon completion of a course.</td>
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<td>16. Who are PowerEdge trainers?</td>
<td>They are expert consultants and practitioners with many years of experience in the subject matter that they deliver on.</td>
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<td>17. Are PowerEdge trainers competent?</td>
<td>We have received numerous favourable feedbacks on our trainers from past participants.</td>
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<td>18. Can PowerEdge assist with Visa travel applications?</td>
<td>We can assist in advising you on the relevant procedure(s) and embassies/consulates that provide Visa for travel purposes.</td>
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<td>19. Can we purchase training materials without attending a course?</td>
<td>Unfortunately this option is not available as training materials are specially developed for courses.</td>
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<td>20. Can course content be tweaked to cater to our needs?</td>
<td>Of course! Just let us know your request and we will get the trainer to assist in carrying it out.</td>
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<th>5 Day Programme</th>
<th>PER PARTICIPANT</th>
<th>2 PARTICIPANTS OR MORE</th>
<th>IN-HOUSE TRAINING</th>
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<td>SGD 4,900</td>
<td>SGD 3,900</td>
<td>Guaranteed Minimum 40% Off Normal Price</td>
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*GST FOR SINGAPORE REGISTERED COMPANIES ONLY

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**PAYMENT METHODS**
- By Cheque/ Bank Draft: Make Payable to PowerEdge Pte Ltd.
- By Telegraphic Transfer: Please quote AE1 with the remittance advice

**CANCELLATIONS & SUBSTITUTIONS**
You may substitute delegates at any time. POWEREDGE PTE LTD does not provide refunds for cancellations. For cancellations received in writing more than seven (7) days prior to the training course you will receive a 100% credit to be used at another POWEREDGE PTE LTD training course for up to one year from the date of issue. For cancellations received seven (7) days or less prior to an event (including day 7), no credits will be issued. In the event that POWEREDGE PTE LTD cancels an event, delegate payments at the date of cancellation will be credited to a future POWEREDGE PTE LTD event. This credit will be available for up to one year from the date of issuance. In the event that POWEREDGE PTE LTD postpones an event, delegate payments at the postponement date will be credited towards the rescheduled date. If the delegate is unable to attend the rescheduled event, the delegate will receive a 100% credit.

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- Fundamentals of Power Systems

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- SGD 3,900

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