

***Probability Methods for Conducting Reliability Analysis for Industrial and Commercial Power (4 hours)***

**Organizer: Dr. Masoud Pourali, KimiaPower PLLC**

**Sunday, October 5, 2014 2:00 PM – 6:00 PM**

Abstract: This tutorial will provide the theoretical background for performing basic reliability analysis for industrial and commercial power systems. Some basic concepts of probability theory are discussed, as these are essential to the understanding and development of quantitative reliability. The objective of this tutorial is to familiarize the audience with upcoming IEEE Std. 3006.5 and provide the basic concepts required for reliability analyses used in the planning and design of industrial and commercial electric power distribution systems. It is necessary to consider the cost of power outages when making design decisions for new and existing power distribution systems, as well as to have the ability to make quantitative “cost-versus-reliability” trade-off studies. This tutorial will provide a review of probability; reliability and availability; probability distributions, probability density functions, cumulative distribution functions; hazard function; Weibull distribution; exponential distribution; methods of reliability and availability analysis; qualitative system analysis; performing reliability and availability analyses; modeling solutions; and common cause failures (CCF).

***Reliability of IGBT Modules in Industrial Applications (4 hours)***

**Organizer: John F. Donlon, Powerex, Inc.**

**Monday, October 6, 2014 8:00 AM – 12:00 PM**

Abstract: This tutorial addresses the reliability of the IGBT power module, which is the heart of modern industrial drives. It has proven to be a highly reliable and rugged component; however, it must be applied within its ratings and capabilities. This tutorial will include a discussion of the proper selection of the IGBT, its limitations and failure modes, the precautions that must be taken to ensure long life, and the design and application considerations that affect reliability. Attendees will gain an understanding of the need to protect the IGBT from internal and external disturbances and practical solutions to over-current, over-voltage, and over-temperature conditions. The presentation will also include a discussion of the latest technology in power modules, including SiC. The tutorial is intended to be of interest to those who use, apply, procure, or specify power electronic products based on the IGBT as the power switch.

***Application Concerns for Medium Voltage Motors and Drives (4 hours)***

**Organizer: Kurt LeDoux, Toshiba International Corporation**

**Wednesday, October 8, 2014 12:30 PM – 5:30 PM**

Abstract: Medium voltage drives are used to control the speed of large electric motors, and many different types of designs are available from suppliers of these products. The different designs present several different challenges, especially for the motor, when a drive is required for an installation. This tutorial will present evidence that solid state starters or reduced voltage starters may not effectively reduce inrush and a drive must be selected. When a drive must be used, variables such as air or water cooling, internal or external transformers, differences in power conversion devices and other design issues have advantages and disadvantages. It is the intent of this tutorial to simplify some of the marketing claims from manufacturers and help the user to make an educated decision when purchasing a variable speed motor controller.

***Protection System Coordination for Modern Distribution and Industrial Power Systems (4 hours)***

**Organizer: Rob Hoerauf, Hoerauf Consulting, Inc**

**Thursday, October 9, 2014 8:00 AM – 12:00 PM**

Abstract: Since the inception of industrial electrical systems, coordination tasks were performed to ensure that protection systems would operate with the necessary reliability and security. The tools to perform such tasks have evolved from the use of a light table and log-log curve sheets into computer programs with Graphic User Interface (GUI). Meanwhile, protective devices have also gone through significant advancements, from electromechanical devices to multifunctional, numerical devices. However, a good number of protection coordination principles have not changed. This tutorial will include the following items: principles and basics of protection system coordination; fault current in symmetrical and unsymmetrical conditions, symmetrical component analysis; modern coordination programs; multifunctional numerical devices used in distribution and industrial systems; coordinating protection of main components of modern distribution and industrial systems; blocking and conditional operations and their use for coordination; and concerns in setting and testing of smart relays and systems.

***Maintenance Considerations and Planning for Electric Power Equipment (8 hours)***

**Organizer: Dan Bumblauskas, University of Northern Iowa, PFC Services Inc., and ABB Inc.**

**Thursday, October 9, 2014 8:00 AM – 5:00 PM**

Abstract: An introduction to various types of transformers and circuit breakers will be provided along with a discussion on the evolution of maintenance practices, including time based maintenance, condition based maintenance, reliability based maintenance, and predictive maintenance. This tutorial will detail two predictive maintenance models, a population data analysis, and an information system architecture which can be utilized to aid operations and maintenance managers with the difficult resource allocation decisions they face in the field. The specific industry of interest is the electrical power equipment industry with a focus on circuit breaker maintenance decision actions and priorities and the development of quotations for such services. This tutorial is of particular interest to operations and maintenance managers working in electric utility industry and those working in the renewable, sustainable, and green energy industries.