

Power Distribution Engineer (PDE) Certificate Program

The PDE is designed to significantly enhance the skills and abilities of engineers working in a distribution utility. The program is intended to provide participants with formal power engineering courses they may not have had in their undergraduate studies and will also serve very well as a refresher for those seeking to “brush-up” their day-to-day engineering skills.

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The PDE curriculum is made up of **four courses**; the first three courses were developed and will be delivered by Retired Dr. Jack Lawler of the University of Tennessee’s School of Electrical Engineering. The fourth course was developed in conjunction with the Electric Power Research Institute (EPRI).

Courses must be taken in sequential order and are listed below.

// Fundamentals of Distribution Circuit Analysis

// Distribution System Components

// Modeling & Analysis of Distribution Systems

// Relaying Protection and Coordination

Owing to the unique nature of this program, a significantly greater level of commitment from participants, and their utilities, is required than is typically for other TVPPA certificate programs.

// Fundamentals of Distribution Circuit Analysis

- *Length of class: 5 days*

This class addresses the principles and methods for analyzing distribution circuits operating under sinusoidal steady state conditions. While an understanding of time differentiation is helpful it is shown that, in steady state, the circuit equations to be solved are algebraic; although the algebra is that of complex numbers. Complex numbers and their use as “phasors” representing sinusoidal time signals is thoroughly explained. The terminal characteristics of resistors, inductors, capacitors and independent sources are explained in the phasor domain. Electric power in ac circuits is far more interesting than in dc circuits where power is simply constant depending on voltage and current level. For ac circuits power concepts include real power, reactive power, complex power, apparent power, power factor angle, and power factor. All of the concepts are defined and demonstrated.

The course includes basic principles of circuit analysis including mesh current and node voltage methods. Additional topics include Thevenin and Norton’s theorems for circuit simplification, power factor correction, per unit notation and calculations, single phase and three phase systems, wye-delta conversions, voltage drop calculations, and short circuit calculations under balanced conditions.

Approximately two thirds of the course time is spent on theoretical concepts and one third on solving illustrative problems. This course will allow distribution engineers from all backgrounds to pursue the more advanced topics in the remaining courses.

// Distribution System Components

- *Length of class: 5 days*

The objective of the second course in the PDE program is to develop the equivalent circuit models of the various components of the electric system including synchronous generators, power delivery equipment such as transformers and lines and motor type loads.

A working knowledge of the structure and parameters of the equivalent circuits of the various system components is essential in a many distribution engineering studies. Distribution System Components aims to provide familiarity with these models as well as in-depth understanding of the physical significance of each element in the equivalent circuit. This understanding is provided through consideration of the basic laws governing component behavior, including the laws of Gauss, Ampere and Faraday.

Course participants will gain appreciation of the fundamental principles of operation underlying
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each component, construction details, and key parasitic phenomena and how they degrade performance, loss mechanisms, and how all of these factors are incorporated into the final equivalent circuit model.

// Modeling & Analysis of Distribution Systems

- *Length of class: 5 days*

This is the third course in TVPPA's Professional Distribution Engineer (PDE) program. Combining the topics from the first two courses of the program, basics of distribution circuit analysis methods and the modeling of the various individual components of the distribution system, the class addresses system level studies. The main distribution system analysis problems of power flow and short circuits will be specifically addressed. The theoretical basis for power flow and short circuit calculations will be combined and applied to small problems suitable for hand calculations and numerical solutions of large systems using a popular commercial grade distribution analysis software package.

// Relaying Protection & Coordination

- *Length of class: 3 days*

The purpose of the course is to teach the fundamentals of distribution overcurrent protection and coordination. The course is suitable for beginning technicians and engineers. Fundamentals are stressed, and students will do many hands-on examples.

The focus of the course is to:

1. Improve overall distribution reliability
2. Improve restoration practices and service resulting in decreased time to restore service
3. Enhance safety through improved applications of system protection devices and use of standardized procedures associated with restoration of service

