THE FUNDAMENTALS OF
POWER DISTRIBUTION AND
POWER SYSTEMS: HANDS-ON PRACTICAL
ANALYSIS AND DESIGN

YOU WILL LEARN HOW TO:

• Have a deeper understanding of the fundamentals of Power Distribution Systems
• Carry out advanced calculations in Power Distribution Systems with greater confidence
• Use the Software provided to carry out Power Distribution System calculations
• Master difficult concepts like three-phase power system network analysis, active, reactive and apparent power calculations, power factor correction and much more
• Extend your learning experience by using the Mathematical Software for your own unique problem solving; use specific solution formulations on your own applications
The Workshop

Practical Engineers and Technicians are always under pressure to meet the day-to-day challenges of maintaining power quality and minimising outages in power distribution networks. As a result of this challenge they tend to sharpen their skills only with regard to the most obvious practical and theoretical tools and to allow other insights that are as necessary to power systems as vitamins are to biological systems, to be relegated to the archives or to the "experts". It is often possible to apply quick-remedies or to use trial and error to obtain "cures" to correct difficult to diagnose faults in Power Distribution Systems. By gaining a deeper and more fundamental understanding of the basics, the traditional trial-and-error approach makes way for deterministic solutions with surer cures. The Simple Software used in this course is MathCAD, with the same power as the full package. It is as easy to use as a word processor with the built-in ability of numerical and symbolic mathematical processing. You write algebraic and mathematical equations as you would write them on paper and the solutions are calculated on an ongoing basis. The package you use understands complex numbers that makes it as easy to calculate voltages, currents and powers in AC power systems as it is to do it with pen and paper for DC. Inherent in the mathematical software are powerful plotting and graphing capabilities that further enhances understanding of less obvious but very important otherwise hidden Power Distribution System workings. In addition to the software, delegates will receive or can download other extremely versatile and powerful numerical integration simulation software by means of which both transient and steady state Power Distribution Circuit performance can be simulated. When used together, the mathematical software and time simulation software supplement and complement each other and will enhance your horizons of understanding of this very important subject.

Practical Sessions

All of the material consists of practical sessions, interspersed with discussion with a live instructor through the use of a web conferencing package. A MathCAD 14 Trial installation disc will be supplied to delegates two weeks before the commencement of the course. A major advantage of presenting the text and math in an integrated mathematical word processor such as that used here is that the e-learning experience is ongoing even after the course has been presented. The formulations used for the different problems can be used afterwards by delegates and solutions, calculations and graphic results can be applied to delegate's own problems.

To gain full value from this workshop, please bring your laptop/notebook computer.

The Program

DAY ONE

• Building the definitions of AC voltages, currents and power on the concepts of time dependent voltage, current and power.
• A review of complex algebra, important trigonometric relations, polar and rectangular coordinate systems.
• Review of DC circuit principles and extending those to AC circuits with sinusoidal waveforms
• Introduction to voltage and current rotating vectors and phasors and their use in AC circuit calculations
• Multiplication and division of complex quantities
• RMS- and average values of periodic waveforms
• Fundamental physical meanings of resistance, inductance and capacitance and their influence power distribution systems
• Impedance of resistance, inductance and capacitance in AC circuits
• Impedance networks and their use in AC circuit calculations
• Time domain simulations of different types of single-phase AC circuits.
• Transient and steady state behaviour of AC circuits
• Admittance, conductance and susceptance and their usage in Power Distribution System calculations
• Principles of AC network Reduction and its use in Power Distribution Circuits

DAY TWO

• Definitions of power in AC circuits, time dependent power, active, reactive and apparent power.
• Getting the direction of power right; sources and sinks
• The role of resistance, inductance and capacitance in AC circuit power dissipation and storage
• Using the software for calculating RMS and Average values of periodic non-sinusoidal waveforms
• The use of real, imaginary and complex power to streamline power calculations in AC circuits
• Phasor Diagrams and their use in AC circuit analysis
• The meaning, consequences and correction of displacement power factor in AC circuits

DAY THREE

• The Nature of balanced three phase power systems; voltage, current and power relationships between the phases
• Comparison of single and three-phase power systems and the advantages of the latter over the former with regard to ampacity and smoothness of power propagation
• Per-phase calculation method and single line diagram representation of balanced three phase power distribution systems
• Analysis and definitions of voltages, current and impedance in three phase networks with star and delta configured sources and loads
• Calculation of power in three-phase power distribution systems
• Time Domain Simulations of examples to complement analytical calculations of three phase power systems
• Development of the equivalent circuit of a power transformer through successive steps in adding winding resistance, leakage inductance, magnetising inductance, core losses
• Transformers and their use in AC power transmission and distribution systems
• Transformer Design Principles; flux density, number of turns, voltage transformation, current ratio, core size, core material implications
• The Per Unit System for Multi-voltage level power distribution system calculations
• Three-phase power transformers and their use in Power Distribution Systems
• Extending single-phase concepts for transformers to balanced three phases
• Calculations and simulations showing phase shift and the effects of different vector groupings
• Wrap-up and discussions

On-Site Training

✔✔ SAVE over 50% by having an IDC workshop presented at your premises.
✔✔ Customise the training to YOUR workplace.
✔✔ Have the training delivered when and where you need it.

Contact us for a FREE proposal.

idc@idc-online.com • www.idc-online.com