

International Research, Education and Training Center NGO (R/C 80550594)
Rahvusvaheline teadus-, haridus- ja koolituskeskus MTÜ
Non-Profit Organization / Mittetulundusühing

TRAINING PROGRAM

FOR ELECTRICAL AND ELECTRONIC ENGINEERING

EHVE-ELECTRICAL HIGH VOLTAGE ENGINEERING-01
EMVE-ELECTRICAL MEDIUM VOLTAGE ENGINEERING-02
ELVE-ELECTRICAL LOW VOLTAGE ENGINEERING-03

TABLE OF CONTENTS

01010-Electrical Circuits Fundamentals
01011-Electrical Circuits and Wiring Systems
01012-Electrical Troubleshooting and Faults
01013-Harmonics in Electric Power Systems: Effects and Prevention
01014-Transformers: Basics, Maintenance, and Diagnostics
01016- Electric Power Distribution Systems Design and Installation
01017-Electrical Design of Overhead Power Transmission Lines and Installation
01018-Electrical Grounding, Surge and Lightning Protection.
01019-Power Distribution Systems. Smart Grid
01020-Maintenance and Troubleshooting of UPS Systems
01021- Electric Motors and Variable Speed Drives
01022- Electrical Distribution Principles and Applications
01023- Power Compensation Control Strategy and Modelling
01024- Supervisory Control and Data Acquisition-SCADA Systems
01025- Partial Discharge Detectors & Testing
01026-Reactive Power Management and Power Factor Correction
01027- Theory and Application of Industrial Electronics
01028- Overhead Lines, Maintenance and Construction
01029- Construction & Design of Overhead Transmission Lines
01030- Cable Termination & Wire Connectors
01031- Load Flow or Power Flow Analysis
01032- Design and Optimization of Overhead Transmission Lines
01033- High Voltage Electrical Safety
01034-Instrumentation, Controls and Electrical Systems for Facilities Engineers
01035- Distributed Control Systems DCS Programming Essentials
01036-Design & Development of Isolated DC to DC Converters (7 Days)
01037- Air Circuit Breaker Construction and Operation
01038- Troubleshooting Printed Circuit Boards, Design, Implementation
01039- Electrical Protection Devices: Construction & Maintenance
01040-Diesel Generator: Operation and Maintenance
01041- Power System Control and Protection
01042-CYMGRD-Grounding Grid Analysis
01043-Industrial Electronics Maintenance Skills
01044-Arc Flash Analysis and Prevention Techniques
01045- Electrical Insulators Specifications
01046- Transmission Lines Operations, Protection and Maintenance
01047-Power Plant Operations and Maintenance
01048-Switchgear and Circuit Breakers
01049-Basic Instrumentation For Process Operators
01050-Digital Image Processing Using MATLAB (DIP)
01051-Introduction to Digital Filters with Audio Applications

01013 Harmonics in Electric Power Systems: Effects and Prevention

Course Description

Problems of harmonics in industrial plants are considered among the biggest issues in industrial distribution systems. This course will introduce the concept of harmonics production and their effects on different equipment supported with practical examples. Understanding harmonic recommendation IEEE 519 will be presented. AC drives, PWM and Inverters will be covered in details. Effect of equipment loading on harmonic currents and total harmonic current distortion will be illustrated with examples using SOLV software. Harmonics mitigation techniques; reactors, commutation reactors, special reactors passive L-C filters, phase shifting, phase staggering, active filters, hybrid active/passive filters and active front ends will also be covered. As a practical part of the course, local site measurements using harmonic measurement equipment will also be done.

Course Objectives

Gaining background about harmonics in industrial distribution
Being familiar with sources of harmonics and AC drive types
Understanding line notching and inter-harmonics
Identifying relationship between harmonic currents and power factors
Understanding harmonics effects on complete range of equipment
Being familiar with resonance in AC drives and pfc equipment
Understanding PWM, DC, AC load commutated inverter and AC cycloconverters

Who Should Attend?

- ✓ Plant Engineers
- ✓ Operations Engineers
- ✓ Electrical Maintenance Engineers
- ✓ Instrument and Control Engineers
- ✓ Electrical Technicians
- ✓ Electrical Inspectors
- ✓ Electrical Maintenance Supervisor

Course Details/Schedule

Day 1

- Introduction and background into harmonics with some examples of problems
- The production of harmonics (single phase and three phase systems)
- Line notching, inter-harmonics etal
- The relationship between harmonic currents and power factors (displacement power)

- Effects of harmonics on complete range of equipment.
- Resonance with example of real life application in Dubai (AC drives and pfc equipmentz)

Day 2

- Sources of harmonics and AC drive types
- PWM, DC, AC load commutated inverter and AC cycloconverters
- Question and answer session.
- Effect of equipment loading on harmonic currents and total harmonic current distortion
- Effect of source kVA, impedance and subtransient reactance (X_d'') on harmonics
- Illustrating Examples using SOLV software

Day 3

- Harmonic mitigation techniques (for three wire and four 3 phase distribution systems and for standard 3 phase systems)
- Reactors (AC line and DC bus), commutation reactors, special reactors (Lineator wide spectrum and duplex reactors)
- Passive L-C filters, phase shifting (multi-pulse), phase staggering (quasi-multi-pulse), active filters, hybrid active/passive filters and active front ends (sinusoidal rectifiers)
- Question and answer session
- Understanding harmonic recommendation IEEE 519 (1992)

Day 4

- Simple harmonic calculation summary
- Example of harmonic calculation software (SOLV) and sample calculations
- Harmonic survey techniques and safety issues
- Local site measurements using harmonic measurement equipment

Day 5

- Information required from vendors (e.g. drive suppliers) to solve harmonics problems
- Question and answer session.
- Conclusion

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