ELECTRICAL DISTRIBUTION SYSTEM ANALYSIS

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INTENDED AUDIENCE : UG and PG

PRE-REQUISITES : Power System Analysis

INDUSTRIES APPLICABLE TO :

1. Power distribution utilities
2. Load dispatch centers
3. Distribution system equipment manufacturers

COURSE OUTLINE :

The structure and load patterns of a power distribution system are significantly different than transmission system. In addition, distribution systems are transitioning from passive to active with the adoption of distributed generation, storage, and smart-grid technologies. Therefore, the analysis tools developed for a transmission system will not be directly applicable to a distribution network. This course shall introduce the modeling of the components (feeders, distribution transformer, regulators, capacitors, loads, distributed generation, storage, etc.) and analysis methods (load flow, short-circuit, etc.), specially developed for the distribution system.

ABOUT INSTRUCTOR :

Prof. Ganesh B. Kumbhar received the B.E. Degree in Electrical Engineering from Government College of Engineering, Karad in 1999, the M. Tech. Degree from the IIT-Madras in 2002, and the Ph.D. degree from the IIT Bombay in 2007. Currently, he is working as Assistant Professor at Department of Electrical Engineering, IIT-Roorkee. Previously, he has worked with Eaton Corporation Ltd., Tata Consultancy Services Ltd., and Crompton Greaves Ltd. in the areas of design and analysis of power system equipment. He has also worked as a Postdoctoral Research Scholar at the Centre for Energy System Research at Tennessee Tech. University, Cookeville, Tennessee, USA. His research interests include distribution system analysis, distributed generation planning and analysis, smart grid technologies and applications, power and distribution transformers, modeling and simulation, design and analysis.

COURSE PLAN :

Week 1: Structure of a distribution system

- 1.1.Distribution feeder configurations and substation layouts
- 1.2.Nature of loads

Week 2: Approximate methods of analysis

- 2.1.Computation of transformer and feeder loading
- 2.2."K" Factors, voltage drop and power loss calculations
- 2.3.Distribution of loads and various geometric configurations

Week 3, 4, 5: Modeling of distribution system components

- 3.1.Overhead lines, feeders and cables
- 3.2.Single and three phase distribution transformers
- 3.3.Voltage regulators
- 3.4.Load models
- 3.5.Capacitor banks
- 3.6.Distributed generation

Week 6, 7, 8: Distribution system analysis

- 4.1.Load flow analysis: Backward/forward sweep
- 4.2.Load flow analysis: Direct approach
- 4.3.Load flow analysis: Direct approach for weakly meshed systems
- 4.4.Load flow analysis: Gauss Implicit Z-matrix Method
- 4.5.Short-circuit analysis: Sequence-components vs. phase-variable
- 4.6.Short-circuit analysis: LG, LLG, LLLG, and LL Faults
- 4.7.Short-circuit analysis: Weakly meshed system
- 4.8.Applications of distribution system analysis