Course Title
Power Transmission & Distribution (RV-10299AD)

Course Hours
1 hour

Course Description
This course covers basic information regarding the transmission and distribution of electric power, including components of transmission lines, transformers and switchgear, substations and electric power distribution systems. General information related to electric service loads is covered, as well as operational aspects and costs involved in transmitting and distributing electric power. The future of electric power transmission is also discussed, providing some thoughts on what trends may be seen in coming years.

Course Objectives
At the conclusion of this course, the student will:

- Be familiar with the main system components involved with electric power transmission and distribution.
- Understand the differences between transmission and distribution and how individual systems are applied between the generating plant and end users.
- Be knowledgeable in the various terms and applications involved with the transmission and distribution of electric power.

Topical Outline

Introduction

Power Transmission and Distribution – 10 minutes

AC (Alternating current) electric transmission is the means by which large blocks of electrical energy are moved from generating sites to load areas that are at varying distances from the power generating plants. Electricity can be moved from the generating plant to an interconnection with a distribution system, or even directly to industrial users.

- Transmission range terms include:
    - Ultra high voltage (UHV) – above 765kV
    - Extra high voltage (EHV) – 345 to 765 kV
    - Transmission – 115, 138, 161, and 230 kV
    - Sub Transmission – 34.5 to 115 kV
    - Distribution – 34.5 kV and below

Transmission Line Components – 10 minutes

This section will provide detailed descriptions of the components that comprise a transmission system and will provide an overall summary of the number of components required to transmit electricity from the generating plant to the residence or business.

- Most economical load routes include:
    - Cost of the real estate being crossed
    - Population densities along the route
    - Bodies of water
    - Terrain ruggedness
    - Presence of swampy areas

Transformers and Switchgear – 10 minutes

A transformer is a static device for transferring energy from one circuit to another magnetically, that is, by induction instead of conduction. Its usual function is to transfer energy between circuits of different voltage. A transformer has a magnetic core on which there are two or more windings.

- Transformer windings come in three basic designs:
    - Concentric layer
    - Helical
    - Disc

Power Substations and Distribution – 10 minutes

Power from the electric transmission grid enters the distribution systems at a distribution substation. This substation is equipped with electric transformers used for reducing voltages from transmission level to primary distribution level.

- Distribution systems are installed in one of several typical arrangements. The most frequent systems are:
    - Radial feed
    - Loop feed
    - Network system

Electric Service Loads – 5 minutes

The main types of loads that will be discussed are:

- Industrial
- Commercial
- Residential
- Suburban
- Rural

Operation of Power Transmission and Distribution Systems – 10 minutes

Operation of the power transmission system is closely tied to the customer demand and to the operation of resource generation. Therefore, both the transmission system and generators need to be operated in such a way as they are synchronized for response to customer demand.

- Thermal constraints
- Voltage constraints
- System operating constraints

Costs of Power Transmission and Distribution – 5 minutes

A major consideration in the construction of transmission systems is the capital and operating costs involved in relation to the transmission capacity. The majority of costs involved in transmission lines are the initial capital costs for constructing the lines.

Future of Power Transmission and Distribution – 5 minutes

The transmission grid is continuously under consideration for upgrades due to the time period during which the vast majority of the grid system was constructed. Current factors such as load growth and new generation plants will contribute to this need for upgrading.

Conclusion