



## **POWER SYSTEMS STUDIES USING ETAP SOFTWARE**

A 5-Day Training Program

### **Introduction:**

The Power System study includes following studies that can be carried out on Power System Study Softwares like ETAP, CYME. These softwares have been found extremely versatile for solving majority of Power System Analysis problems.

### **Course Objectives:**

Upon completion of this course, the participant should be able to:

- ✚ Perform power system studies using ETAP program
- ✚ Know different power distribution systems and design
- ✚ Know grounding systems and design
- ✚ Perform short circuit studies for transmission systems and distribution systems by Hand Calculations and using ETAP program
- ✚ Calculate cable current rating for different installations by Hand Calculations and using ETAP program

### **Who Should Attend?**

This course is intended for Junior and Senior Engineers.

### **Daily Outline**

#### **Day 1:**

#### **Power System Studies using ETAP**

- ✚ Steady State
- ✚ 2. Transient State
- ✚ Insulation Coordination
- ✚ SASO Voltage ratings/ standards and applications in Yanbu.
- ✚ KW, KVAR, KVA, KWH, Energy Demand, Power Factor, Frequency, Inductive Reactance, Capacitive Reactance, Phase Angle, Over Voltage, Over load, Load Factor, Diversity Factor, BIL, Ambient Compensation, Leakage Current, UPS.
- ✚ Voltage Regulation, Voltage Control, VAR Control
- ✚ Harmonic/Distortion



- ✦ Resonance
- ✦ Stability
- ✦ 10. Load Estimating

### **Day 2:**

#### **Institutional, Commercial and Residential Facility Power Distribution Systems and Design**

- ✦ Facility Load Estimate based upon VA/ square meters and establishment of Power Distribution System Architecture
- ✦ Open Loop/Ring 13.8kV Distribution System on Complex Facility Site.
- ✦ Low Voltage Radial Distribution System within Buildings
- ✦ Ampacity Calculation for Cables in Underground Duct Banks.
- ✦ Voltage Drop Calculations
- ✦ Cable Pulling Calculations to locate Manholes, Handholes and Pull Boxes
- ✦ Selection of Circuit Breakers for Cable Protection

### **Day 3:**

#### **Grounding Requirements, Methods & Systems**

- ✦ System Grounding and Electrode Conductor Selection
- ✦ Equipment Grounding and Conductor Selection
- ✦ Bonding

### **Day 4:**

#### **Short Circuit Studies for 380kV, 115 kV Transmission Systems 34.5kV and 13.8 kV Distribution Systems by Hand Calculations and using ETAP program**

- ✦ Short Circuit studies for 115 kV and 13.8kV distribution systems by hand calculations and using ETAP program
- ✦ Symmetrical Components and application for 3-phase, phase-to-ground and phase-to-phase short circuit calculations
- ✦ Calculation of impedances for transformers, generators, underground cable circuits, overhead transmission circuit calculations.
- ✦ Per unit and percent system impedance presentation methods
- ✦ IEC and IEEE calculation methods
- ✦ ETAP program
- ✦ Calculation of motors contributions.



- ✚ Symmetrical and asymmetrical short circuit currents
- ✚ Interrupting and momentary short circuit currents
- ✚ Network and radial systems.
- ✚ Solidly grounded and resistance grounded systems.
- ✚ Transformer connections

### **Day 5:**

### **Cable Current Rating Calculations for 380kV, 115kV, 34.5kV, 13.8 kV and 380 Volt Cables as installed in Duct Banks, Direct Buried and Indoor Conduits. Perform Calculations both by Hand and using ETAP Program**

- ✚ Underground cable ampacity using IEC 287
- ✚ Cable ampacity calculation using ETAP
- ✚ Cable ampacity calculation using the NEC
- ✚ Conductors ampacity calculation using the IEC 364-5-523