Power System Protection and Analysis

Course Objectives

The delegate will gain detailed appreciation of:

- To know the different types of relays and it's principal of operation.
- To know how to make relay coordination for main and back-up protection relays on Ike network.
- To know how to find the cause of relay operation and verify if it is correct, false or mal operation
- To know how to protect the power system due to up normal operational conditions.
- To know the art of advanced microprocessor based protection

Course Outline

- Fundamentals of protection practice
- Protective gear
- Reliability
- Selectivity
- Zones of protection
- Stability
- Sensitivity
- Primary and back- up protection
- Definitions and terminology
- Relay contact systems
- Operation indicators

    *Worked example on using single line diagram and reading through it.

Fault calculations

- Symmetrical component analysis of a three phase network
- Equations and network connections for various types of faults
- Current and voltage distribution in a system due to fault
- Effect of system Earthing on zero sequence quantities

- Circuit breakers - bulk oil, air-blast, vacuum, SF6

  Current transformers

  Voltage transformers

  *Worked example on calculations of short circuit level and point of common coupling.

Over current and earth fault protection

- Co-ordination procedure
- Principles of time/current grading
- Grading margin
- Standard I.D.M.T. over current relay
- Combined I. D. M.T. and high set instantaneous over current relay
- Very inverse over current relay
- Time / current characteristics
- Earth fault protection
- Parallel feeders
- Ring mains
- Directional earth fault relays

Over current and earth fault protection

- Distance Protection
- Principles of distance relays
- Relay performance
- Relationship between relay voltage and Z_S /Z_I – ratio
- Standards of relay performance
- Close-up faults
- Relay types and their application
- Plain impedance relay
- Relay setting

  *Worked example to calculate the relay setting of o.c and distance relays

- Bus-bar faults
- Protection requirements

- Differential protection using high impedance relays
- Location of current transformers
- *Transformer and Transformer Feeder Protection*
- *Nature and effects of transformer faults*
- Principles of transformer protection systems
- Generator and Generator-Transformer
- Earthing and earth faults
- Phase faults
- Inter-turn faults
- Winding protection
- Inter-turn fault protection of the stator winding
- Overload protection
- Over current protection
- Back-up earth fault protection
- Power frequency over voltage
- A.C Motor Protection
- Heating of motor windings
- Overload protection
- Motor currents during starting and stall conditions
- Stalling motors

*Worked example to calculate the starting current of induction motors.

Course Instructor

Prof. Dr.Ossama El-Sayed Gouda is the professor of electrical Power engineering and high voltage in the Dept. of electrical power and machine, Faculty of Engineering, Cairo University since 1993.He teaches several courses in Power system, High voltage, Electrical machine, Electrical measurements, Protection of electrical power system &Electrical installation He is a consultant of several Egyptian firms. He conducted more than 90 papers in the field of Electrical power system and High voltage engineering. He supervised about 35 M.SC. &

Ph.D. thesis .He conducted more than 150 short courses about the Electrical Power, Machine & High voltage subjects for the field of Electrical Engineers in Egypt & abroad

Who Can Benefit?

This course is for Electrical Engineers & Electricians