

**MODULE : TB13**

**PROTECTIVE RELAY SELECTION, APPLICATION AND RELAY SETTINGS - 3 DAYS**

**COURSE DESCRIPTION:**

- Types of fault
- Shunt faults : Three Phase fault, phase to ground fault, Magnitude of fault currents for solidly grounded, high and low resistance grounded systems, fault detection in ungrounded system.
- Series faults : one-phase open, two-phase open, effects on system.
- Equipment and typical protections :
  - Transformer : Protections on HT side, LT side; Unit protections (differential, REF)
    - Applicable protections based on ratings.
  - Generator : Plain over current and voltage restrained over current protections, stator earth fault (95% & 100%) protection, Back up impedance protection, Unit protections (differential, REF), Influence of neutral grounding on protection.
  - Feeder protection – Incomer to switchgear
  - Feeder protection – outgoing from switchgear
  - HT motor protection – composite protection, influence of source grounding
  - LT motor protection
  - Tie feeder protection – Pilot wire protection
  - Busbar protection
- Typical relays used for transformer, generator, feeder, motor, bus, pilot wire protections in Numerical,  $\mu$ P / Static and Electro-mechanical ranges.
- Comparison Chart: characteristics of relays of different vendors.
- Definition – NI, VI, EI, LI characteristics – IEC curves – formula and limitations.

- Application of DMT and IDMT (NI, VI, EI, LI) in power network - Where to use and where *not* to use.
- Numerical relays – advantages, precautions in use / settings.
- Primary and back up protection.
- Need for coordination.
- 3 S – Sensitivity, Selectivity and Speed.
- Discrimination time – empirical formula: Fuse IDMT, Instantaneous to IDMT and IDMT to IDMT for Electromechanical relays and numerical relays.
- Concept of Plug setting multiplier and time multiplier setting.
- Criteria for setting plug and time dial for IDMT / DMT relays.
- Phase and Ground Instantaneous over current relays – application and setting criteria, need for stabilizing resistor.
- Pilot wire protection – How upstream operating time can be reduced.
- CT brief primer : Protection class, accuracy and ALF, voltage developed across CT secondary, CT for numerical relay applications.
- Class room exercise : Step by step relay setting and co-ordination exercise for phase fault and ground fault relays; Application and selection checks with conventional and numerical relays.
- Case studies : Selection of relays for transformers of medium and large size, emergency generators, motor feeders; Selection of earth fault relays for solidly grounded, medium resistance grounded and high resistance grounded systems.