



Power Systems Protection – Control and Stability Training

Description

Course Description

This course has been designed to give plant operators, electricians, and field technicians and engineers a better appreciation of the role played by Power System Protection systems. An understanding of power systems along with correct management will increase your plant efficiency and performance as well as increasing safety for all concerned. The course is designed to provide excellent understanding on both a theoretical and practical level. The course starts at a basic level, to ease the engineer and technician into the perhaps forgotten art of studying, and provide a refresher to those who are more familiar with the basic topics covered. The course then moves onto more detailed applications.

The course features an introduction covering the need for protection, fault types and their effects, simple calculations of short circuit currents and system earthing. The course also includes some practical work, simple fault calculations, relay settings and the checking of a current transformer magnetisation curve.

Course Objective

Participants attending this programme will gain a detailed appreciation of the following:

- The need for protection
- An overview of power system fault analysis
- Protection fundamentals
- Relay transducers, both current and future
- System grounding principles
- Overcurrent earth fault protection
- Coordination principles
- Transformer protection
- Generator protection
- Bus protection

- Motor protection
- Line and feeder protection
- Principles of relay application

Course Outline

NEED FOR PROTECTION

- Selectivity, stability, sensitivity, speed, reliability, dependability, security

FAULT TYPES & THEIR EFFECTS

- Active, incipient, passive, transient, asymmetrical
- Phase & earth faults

SIMPLE CALCULATION OF SHORT CIRCUIT CURRENTS

- Revision of simple formulae
- Calculation of short circuit MVA & fault currents
- Worked examples

SYSTEM EARTHING

- Solid, impedance, touch potentials
- Effect of electric shock
- Earth leakage protection

PROTECTION SYSTEM COMPONENTS INCLUDING FUSES

- History, construction & characteristics
- Energy let through & applications

INSTRUMENT TRANSFORMERS

- Current transformers: construction, performance, specification, magnetization curves
- Voltage transformers: types, accuracy, connections

CIRCUIT BREAKERS

- Purpose & duty, clearance times, types

TRIPPING BATTERIES

- Battery types, chargers, maintenance, D.C. circuitry

RELAYS

- Inverse definite minimum time (IDMT) relay
- Construction principles and setting
- Calculation of settings – practical examples

- New Era – modern numerical relays & future trends

PRACTICAL DEMONSTRATIONS AND SESSIONS

- Including simple fault calculations and relay settings
- CO-ORDINATION BY TIME GRADING
- Problems in applying IDMT relays

LOW VOLTAGE NETWORKS

- Air & molded circuit breakers
- Construction and installation
- Protection tripping characteristics
- Selective co-ordination (current limiting, earth leakage protection, cascading)

PRINCIPLES OF UNIT PROTECTION

- Differential protection – basic principles

FEEDER PROTECTION

- Cables
- Pilot wire differential
- Overhead lines
- Distance protection (basic principles, characteristics, various schemes)

TRANSFORMER PROTECTION

- Phase shift, magnetising in-rush, inter-turn, core & tank faults
- Differential & restricted earth fault schemes
- Bucholz relay, oil & winding temperature
- Oil – testing & gas analysis

SWITCHGEAR (BUSBAR) PROTECTION

- Requirements, zones, types
- Frame leakage
- Reverse blocking
- High, medium & low impedance schemes

MOTOR PROTECTION

- Thermal overload, time constraints, early relays, starting & stalling conditions
- Unbalanced supply voltages, negative sequence currents, de-rating factors
- Phase faults protection
- Earth faults – core balance, residual stabilising resistors

GENERATOR PROTECTION

- Stator & rotor faults
- Overload & over-voltage
- Reverse power, unbalanced loading
- Loss of excitation and synchronism
- Typical protection scheme for industrial generators

OVERHEAD LINE PROTECTION

- Basic principles of the distance relay
- Tripping characteristics
- Application onto power lines
- Effect of load current & arc resistance
- Various schemes using power line carrier

MANAGEMENT OF PROTECTION

- Routine & annual testing, investigation and performance assessment, upgrading

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