

PROTECTION OF ELECTRICAL SYSTEMS

ELC010

COURSE DESCRIPTION

This course presents a comprehensive and systematic description of the concepts and principles of operation and application of protection schemes for various power system elements. Our course begins with an overview of power system faults, short circuit calculations, components of power system protection schemes, as well as a full session on microprocessor-based protective relays and their application.

COURSE GOAL

To enhance the participants' knowledge, skills and abilities necessary to understand operation and application of protection schemes for various power system elements.

COURSE OBJECTIVES

By the end of this course, participant will be able to:

- Know the basic electrical system protection techniques including fault analysis.
- Understand protective devices.
- Understand problems generally faced and solutions successfully adopted by industry.
- Learn to calculate the basic fault currents flowing in any part of the electrical system.
- Improve your electrical system protection against faults and over voltages.

WHO SHOULD ATTEND

- Electric power engineers.
- Supervisors and qualified technicians.
- Other engineers like mechanical, communication engineers.

COURSE DURATION

5 Working Days

COURSE OUTLINES

1. Power System Faults

- Different types of faults
- Incidence of faults on power system equipment
- Effects of power system faults

- Magnitude of fault current, short circuit calculations
- Detection of faults
- Clearance of faults
- Requirements of protective relaying systems

2. Short Circuit Theory and fault studies

- Effects of short circuit
- Fault current sources
- Fault current characteristics
- Equipment ratings
- Fault calculations

3. Components of Power System Protection Schemes

- Fault detecting relays
- Tripping relays and other auxiliary relays
- Circuit breakers - bulk oil, air-blast, vacuum, SF6
- Current Transformers
- Voltage Transformers
- Ground Transformers
- The transition from electro-mechanical relays to electronic and digital microprocessor-based relays
- The application of programmable logic controllers
- Modern microprocessor-based relays: review of types available

4. Current Transformers (CTs) & Voltage Transformers (VTs)

- Various types of CTs, VTs & CVTs
- Theory and characteristics of CTs
- Application requirements of CTs for protective relaying
- Accuracy classifications
- Future trends in CT design
- Testing of CTs and VTs

5. Co-ordination of Electrical Protection Systems

- Fuse to fuse
- Circuit breaker to fuse
- Fuse to circuit breaker



- Back up protection
- Limitation of fault current
- Selective zones of protection
- Types of bus protection schemes
- Basic concept of differential protection
- Application to various bus configurations
- Applications to switchboards
- Testing of bus protection schemes

6. Feeder Overcurrent Protection

- Protective relaying requirements for loop and radial systems
- Elements of feeder protection schemes
- High set, low set, and inverse -timed elements
- Co-ordination with other devices and fuses
- Auto-reclosing of feeder circuit breakers
- Various types of overcurrent relays
- Electromechanical, electronic & digital relays
- Relay setting criteria
- Testing of overcurrent protection schemes

7. Transformer Protection

- Overcurrent and ground-fault protection
- Application of differential protection to transformers
- Gas relays, pressure and gas accumulation
- Winding temperature and oil temperature devices
- Testing of transformer protection schemes
- Modern microprocessor-based multi-function relays-available functions, application and testing

arctic