



Fundamental of power system protection and IEC 61850

❖ *Module Objectives*

- To understand the importance of power system protection
- To identify the types of faults in power system and analyze them
- To understand the earthing system and the associated types
- To understand the components of power system and the mechanism of working
- To choose the type of protection depending on the network location.
- To understand the work of protective devices coordination
- To understand the application of the standard IEC 61850

❖ *Learning Outcomes*

At the end of the module, students/trainees will be able to:

- Determine of the faults in the power system
- Study the power system protection
- Choose the appropriate protection devices
- Coordinate of protection working in the power systems
- Study and select the appropriate earthing systems

❖ *Module Description*

Electric power systems are becoming increasingly complex in nature due to the integration of distributed energy resources. This module covers introduction to power system protection, which is a branch of electrical power engineering that deals with the protection of electrical power systems from defining the faults through the isolation of this fault. The objective of a power system protection is to keep the power system stable by isolating only the components that are under fault, whilst leaving as much of the network as possible still in operation. Thus, protection schemes must apply a very pragmatic and pessimistic approach to clearing system faults. The protection devices that are used to protect the power systems from faults.

This module includes seven chapters: The first chapter introduces the fundamentals of power system protection. Then, the system earthing will be studied in chapter 2. After that, the components of protection system will be explained. The coordination and management of the protection devices will be presented in chapter 4. In the fifth chapter, the methods of protection of power system components will be reviewed.



The protection of distribution/transmission networks will be explained in chapter 6. Finally, IEC 61850 standard will be presented, and its application will be also explained.

❖ *Module Content*

Chapter 1: Fundamental of power system protection

- Need for protection
- Faults, types, and effects
- Simple calculation of short-circuit currents
- Characteristics of a good protection

Chapter 2: system earthing

Chapter 3: Components of protection systems

- Instrument transformers: CT and VT
- Circuit breakers: types and comparison of CB types
- Protection relay: traditional, digital, and Smart relays
- Tripping batteries
- Experimental Assessment of Relay Operating Performance

Chapter 4: Coordination and management of protection devices

- Timing coordination
- Sensitive fault earth protection
- Reliability protection
- Speed protection
- Protection zones

Chapter 5: Transformer, Switchgear and generator protections

- Types of transformer fault
- Differential protection
- Types of busbar fault



- Parallel operation of a generator with the grid

Chapter 6: Protection of distribution and transmission networks

Chapter 7: Protection and control communications with IEC 61850 standard

- Introduction to communication protocols
- Overview of IEC 61850
- Reference model of and the structure of IEC 61850
- The data model
- Application of IEC 61850 for substation protection
- Future application of IEC 61850 in Smart Grids

❖ References

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2. Amila Pathirana, C. K. G. Piyadasa, Athula D. Rajapakse "Development and modelling of a new type of sensor for detecting current transients for *powersystem protection*" *International Journal of Electrical Power & Energy Systems*, Volume 101, October 2018, Pages 243-254
3. Mason, C. Russell. "*The Art and Science of Protective Relaying*" (PDF). *General Electric*. Retrieved 2009-01-26.
4. Xavier Vallvé, Trama Tecno Ambiental, "EARTHING AND LIGHTNING OVERVOLTAGE PROTECTION FOR PV PLANTS" United Nations Development Programme, www.lb.undp.org 2013.