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Electrical Power System Protective Relays

Learn Three Aspects (Normal Operation, Prevention of Electrical Failure and Mitigation of the effects of Electrical Failure)

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In Apex .....

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Electrical Power System Protective Relays

COURSE OVERVIEW:

The quality of Electric Power is an ever-growing concern today for both utility supplier and consumers. For that, all system components (Generators, Transformers, Transmission Lines Feeders, Motors, Busbars, ..) have to be adequately protected to avoid major system disturbances, which may cause system instability or damage to equipment if faults on the system are not cleared within specified fault clearing times.

Protection of the **Power System** requires an understanding of system faults and their detection, as well as their reliable safe isolation from the system. This course presents comprehensive and systematic descriptions of the concepts and principles of application and operation of protection schemes applied for various power system elements. Many utilities need this course that studies the relay characteristics during faults and weak protection points in electrical power systems.

WHO SHOULD ATTEND?

The course curriculum is designed for Electric Power Engineers, Supervisors, and Foreman involved in the Control, Operation, and Protection of Electric Power Systems. It is also intended for consulting and manufacturing Engineers as well as Engineers with protective relaying equipment supply companies.

COURSE OBJECTIVES:

This course is designed to review for the participants the fundamental concepts of protective relaying and fault current calculations using symmetrical components. Also after they completed this course they will be gain more benefits such as:

- Knowing the Fault Reasons in Electrical Networks and their effect on the electrical quantities
- Understanding main Concepts of Protection equipment and its necessity in electrical System
- How to make relay coordination for main and back-up protection relays on electrical network
- How to find the cause of relay operation and verify if it is correct, falls or mal operation
- How to protect the Power System due to Abnormal Operating Conditions

COURSE OUTLINES:

MODULE (01)

The Philosophy of Protective Relaying

1.1 What is Protective Relaying?
1.2 The Function of Protective Relaying
1.3 Fundamental Principles of Protective Relaying
1.4 Protection Against Other Abnormal Conditions
1.5 Functional Characteristics of Protection Relaying
1.6 Protective Relaying Versus a Station Operator
1.7 Understanding Tripping Versus Failure to Trip when Desired
1.8 The Evaluation of Protective Relaying
1.9 How do protective Relays Operate?
1.10 Case Studies (Problem/Situation)

MODULE (02)

Relay Operating Principles and Characteristics

2.1 General Consideration
2.2 Operating Principles
2.3 Time Delay and Definitions
2.4 Single Quantity Relays of the Electromagnetic Attraction Types
2.5 Directional Relays of the Electromagnetic Attraction Type
2.6 Induction Type Relays General Operating Principles
2.7 Single Quantity Induction Relays

MODULE (03)

Distance Relays

3.1 The Impedance - Type Distance Relay
3.2 The Modified Impedance Type Distance Relay
3.3 The Reactance Type Distance Relay
3.4 The MHO Type Distance Relay
3.5 Consideration applicable to all Distance Relays
3.6 Case Studies

MODULE (04)

Current Transformers

4.1 Types of Current Transformers
4.2 Calculation of CT accuracy
4.3 Ration Correction Factor Curves
4.4 Polarity and Connection
4.5 The Zero Phase Sequence Current Shunt
4.6 Series Connection of Low Ration Bushing CT's

COURSE OUTLINES:

MODULE (05)

Voltage Transformers

5.1 Accuracy of Potential Transformers
5.2 Capacitance Potential Devices
5.3 Rated Burdens of Class a Potential Devices
5.4 Standard Accuracy of Class a Potential Devices
5.5 Effect of Overloading
5.6 Non-Linear Burdens
5.7 The Use Low Tension Voltage
5.8 Polarity and Connection

MODULE (06)

Methods for Analyzing Generalizing and Visualizing Relay Response

6.1 The R– X Diagram
6.2 Phase to Phase Short Circuits
6.3 Power Swings and Loss of Synchronism
6.4 Effect of a WAY– DELTA or A DELTA-WYE Power Transformer between Distance Relays and A Fault
6.5 Effect on Distance Relays of Power Swings or Loss of Synchronism
6.6 Simplified methods to Estimate Liquid Properties
6.7 Response of Polyphase Directional Relays to Positive and Negative Phase Volt - Amperes
6.8 Response of Single –Phase Directional Relays to Short Circuit
6.9 Phase Sequence Filters

MODULE (07)

Bus Protection

7.1 Protection by Back up Relays
7.2 The Fault Bus
7.3 Directional Comparison Relaying
7.4 Current Differential Relaying with Over current Relays
7.5 Current Differential Relaying with Percentage Differential Relays
7.6 Partial - Differential Relaying
7.7 Effect on Distance Relays of Power Swings or Loss of Synchronism
7.8 Voltage Differential relaying with “Linear Couples”

MODULE (8)

Transformer Protection

8.1 The Current Transformer Connections for Differential Relays
8.2 The Zero-Phase - Sequence Current Shunt
8.3 Current - Transformer ratios for Differential Relays
8.4 Protecting A Three Winding Transformer with A TWO Winding Percentage Differential Relay
8.5 Effect of Magnetizing - Current Inrush on Differential Relays
8.6 Protection of Parallel Transformer Banks
8.7 Short Circuit Protection with Overcorrect Relays
8.8 Grounding Protective Relay
8.9 External Fault Back up Protection
8.10 Power Rectifier Transformers

MODULE (9)

Line Protection with Distance Relays

9.1 The Choice between Impedance, Reactance, or MHO
9.2 The Adjustment of Distance Relays
9.3 Effect of ARCs on Distance Relay Operation
9.4 Effect of Intermediate Current Sources on Distance Relay Operation
9.5 Effect of Power Transformers Magnetizing - Current inrush on Distance Relay Operation
9.6 The Connections of Ground Distance Relays
9.7 Increasing the Efficiency of Process Furnaces
9.8 Electric ARC Furnace Transformers

MODULE (10)

Line Protection with Pilot Relays

10.1 Wire Pilot Relaying
10.2 Obtaining Adequate Sensitivity
10.3 The Protection of Multi-terminal Lines
10.4 Current Transformer Requirements
10.5 Back up Protection
10.6 Carrier Current Pilot Relaying
10.7 Types of Relaying Equipment
  10.7.1 Phase Comparison
  10.7.2 Direction Comparison
  10.7.3 Combined Phase and Directional Comparison
10.8 All Electronic Directional - Comparison Equipment

Course Summary & Conclusion

About Instructor

Dr. Mohamed El-Hadidy

Technical Consultant,

Egyptian Electricity Transmission Company

Dr. El-Hadidy is the Technical Consultant for the Egyptian Electricity Transmission Company (EETC) since 2004; he provides Technical Consultations to the Egyptian Electricity Holding Company (EEHC) and its affiliated Generation, Transmission and Distribution companies. He is also a Consultant for the Egyptian Electricity Regulatory Agency. Dr. El-Hadidy has been the EETC Deputy Chairman for Power System Planning, Studies and Projects during the period 2001-2004. For more than 11 years starting from ,1990 he has carried the main responsibility of the Egyptian Power System Protection, Testing, Metering and Disturbance Analysis. He has shared in the Studies, Operation and Protection works of the Electrical Interconnections between Egypt-Jordan and Egypt-Libya.

Dr. El-Hadidy was born in Egypt in 1944. Since receiving B.Sc. degree of Electrical Power Engineering in 1967 from Ain-Shams University, Cairo, Egypt, he has been working with the Egyptian Electricity Sector until now. In 1979 he received his Ph.D. degree from Moscow Power Institute in the former Soviet Union. *.The Analysis and Development of the EHV Network Protection.* was the theme of his Ph.D. research.

Dr. El-Hadidy main interests are Studies and Research in the fields of Power System Protection, Control, Planning, Operation, Monitoring, Quality of Supply, Disturbance Analysis and Performance Evaluation. He is also interested in Training, Teaching and Lecturing in those fields. He has supervised many M.SC. and Ph.D. researches in the Egyptian Universities.

Dr. El-Hadidy is the author and co-author of many technical papers and reports published in local and international proceedings. He has attended many conferences, meetings and training courses in Egypt and abroad; and has honored the 2006 Best Paper Award and Certificates of Appreciation from the Fault and Disturbance Analysis Conference under Georgia Institute of Technology, USA; the paper title was: *.Phasor Measurement as a New Application of Disturbance Recorders*..

COURSE FEE

The amount of **3500 USD** will be charged for the course fee. Send (3) delegates and get a *10% discount* on the third participant.

PAYMENT METHOD

A confirmation letter will be sent upon your registration. Note that full payment must be made prior to the event. Only those delegates who have paid in full will be admitted to the event. All payments should be to APEX Account:

HSBC Bank Middle East limited,

Jebel Ali Branch, Dubai, UAE

A/C: 035 - 626472 - 101

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CANCELLATION

If you are unable to attend the course you may send a substitute delegate.

Cancellation should be made 20 days prior to the course conduction. Failure to cancel within 10 days will be required to pay the course fee in full amount.

REGISTRATION FORM

Name (Mr./Ms.)_____

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