Protective relays
Course Outcome Summary

Course Information

Project Type	Course Outline
Organization	Electricity & Water Training Institute
Developers	Electrical Networks Department team (EWT)
Development Date	7/4/2007
Revised By	Eng. alothman & Eng. baker
Instructional Level	Diploma
Instructional Area	Electrical Engineering
Department	Electrical Networks
Total Credits	4

Description
This course covers different types of electrical network faults and thier protective relays used to prevent the sub-station from them

Target Population
High school graduated students whom finished the introductory course which is required by the Electricity and Water Training Institute.

Textbooks

Electrical Network Deparment. *handout*.

Learner Supplies

Calculator.

Handout.

Exit Learning Outcomes
Core Abilities

A. Learn effectively
    1. learner takes responsibility for self as a learner
    2. learner uses resources to meet learning needs
    3. learner identifies, organizes, assimilates, and integrates information and ideas
    4. learner produces evidence of learning
B. Think critically and creatively
    1. learner identifies a problem to be solved, task to be performed, or decision to be made
    2. learner applies the principles and strategies of purposeful, organized thinking
    3. learner evaluates information
    4. learner distinguishes facts, inferences, and judgements
    5. learner makes decisions considering alternatives and consequences
    6. learner draws logical conclusions from evidence

7. learner supports viewpoints/arguments with reason and evidence

C. Act responsibly
   1. learner takes responsibility for his/her own learning and actions
   2. learner completes assigned tasks according to prescribed deadlines and quality standards
   3. learner adheres to established attendance criteria/standards
   4. learner maintains a safe and healthy work environment for self/group

D. Work cooperatively
   1. learner contributes to a work-based team to accomplish common goals
   2. learner exchanges information, ideas, and opinions in a team/group setting
   3. learner participates in shared problem-solving.
   4. learner demonstrates respect in relating to people
   5. learner resolves conflicts in a constructive manner
   6. learner completes his/her share of tasks necessary to complete a project

E. Solve problems
   1. learner identifies problems to be solved, tasks to be performed, or decisions to be made.
   2. learner formulates alternative solutions, processes, or decisions and identifies potential consequences.
   3. learner selects appropriate solutions, processes or decisions.
   4. learner evaluates problems, monitors the feedback and revises plans indicated by the findings.

F. Communicate effectively
   1. learner comprehends written materials
   2. learner writes clearly, concisely, and accurately
   3. learner speaks so others can understand
   4. learner demonstrates active listening skills

G. Use technology
   1. learner analyzes technology resources to meet needs.
   2. learner selects and uses appropriate technology
   3. learner uses technology to communicate
   4. learner solves problems using technology
   5. learner uses appropriate technology to manage information

Program Outcomes

A. Apply The Electrical Safety Rules
B. Use the Sub-Station Lay Out
C. Maintain Protective Relays and C.T., P.T. (O/C, E/F, Diff., etc.)
D. Carry Out the Preventive Maintenance For Circuit Breaker (Oil, SF6, Vacuum, Air)
E. Maintain the SwitchGear Panel (Bus-Bar, Isolator, Terminals, Cable End Box, Local Cubical)
F. Prepare And Maintain Batteries And Battery Chargers (220V, 110V, 50V)
G. Carry Out the Preventive Maintenance For Power Transformer
H. Maintain The Motor-Starter
I. Use Electrical Measuring Instruments
J. Use Electrical Maintenance Forms In English

Competencies

1. Review the components which connects protective and power circuits

You will demonstrate your competence:

- o In the classroom
- o By a written assignment

Your performance will be successful when:

- o Learner will solve the given assignment on time
- o Learner will follow the given procedure in the given assignment
- o Learner will submit the assignment on time
- o Assignment meet the given requirement

Learning Objectives

a. Identify current transformer construction
b. Identify current transformer characteristics
c. Identify current transformer site tests
d. Identify current transformer routine and maintenance tests
e. Draw the connection of current transformer
f. Identify voltage transformer construction
g. Identify voltage transformer characteristics
h. Identify voltage transformer site tests
i. Identify voltage transformer routine and maintenance tests
j. Draw the connection of voltage transformer
k. Classify different types of voltage transformers
l. Study auxolary of protection elements

2. Specify protective relays specifications

You will demonstrate your competence:

- o In the classroom
- o By a written assignment

Your performance will be successful when:

- o Learner will solve the given assignment on time
- o Learner will follow the given procedure in the given assignment
- o Learner will submit the assignment on time
- o Assignment meet the given requirement

Learning Objectives

a. Identify sensitivity of protective relays
b. Identify relaibility of protective relays
c. Identify speed of protective relays
d. Identify selectivity of protective relays
e. Study nature of relaying
f. Identify power system and bus configurations

3. Analyze electrical network faults

You will demonstrate your competence:

- o In the classroom
- o By a written assignment

Your performance will be successful when:

- o Learner will solve the given assignment on time
- o Learner will follow the given procedure in the given assignment
- o Learner will submit the assignment on time
- o Assignment meet the given requirement

Learning Objectives

a. Analyze symmatrical components of three phase network
b. Identify zero sequance network
c. Identify negative sequance network
d. Identify positive sequance network
e. Analyze equations and network connectons for various types of faults
f. Identify single phase earth fault
g. Identify double phase fault
h. Identify double phase earth fault
i. Identify three phase fault

4. Study over current protection techniques

You will demonstrate your competence:

- o In the classroom
- o By a written assignment

You performance will be successful when:

- o Learner will solve the given assignment on time
- o Learner will follow the given procedure in the given assignment
- o Learner will submit the assignment on time
- o Assignment meet the given requirement

Learning Objectives

a. Study principles of time/current grading
b. Study principles of over current relays
c. Identify basic tipes of over current relays
d. Compare between different types of over current relays
e. Identify inverse time delay over current relay's characterictics
f. Identify very inverse time delay over current relay's characterictics
g. Identify extermly inverse time delay over current relay's characterictics
h. Identify directional over current relays

5. Study earth fault protection techniques

You will demonstrate your competence:

- o In the classroom
- o By a written assignment

Your performance will be successful when:

- o Learner will solve the given assignment on time
- o Learner will follow the given procedure in the given assignment
- o Learner will submit the assignment on time
- o Assignment meet the given requirement

Learning Objectives

a. Study priciples of earth fault relay

b. Identify basic types of earth fault relay
c. Compare between diffrernt types of earth fault relay
d. Identify I.D.M.T earth fault relay characteristics
e. Identify directional earth fault relay

6. Study differenial protection techniques

You will demonstrate your competence:

- o In the classroom
- o By a written assignment

Your performance will be successful when:

- o Learner will solve the given assignment on time
- o Learner will follow the given procedure in the given assignment
- o Learner will submit the assignment on time
- o Assignment meet the given requirement

Learning Objectives

a. Study principles of differential protection relay
b. Identify basic idea for differentail brotection
c. Study baised differential protection relays
d. Compare between matching and simulation transformers
e. Study the function of restraining and operating coils
f. Draw the equivalent circuit for differential relay

7. Study SOLKER differenial protection techniques

You will demonstrate your competence:

- o In the classroom
- o By a written assignment

Your performance will be successful when:

- o Learner will solve the given assignment on time
- o Learner will follow the given procedure in the given assignment
- o Learner will submit the assignment on time
- o Assignment meet the given requirement

Learning Objectives

a. Classify mechanical and electrical protection relays of power transformer
b. Identify mechanical protection of power transformer
c. Identify the main electrical protection of power transformer
d. Identify the elctrical backup protecion of power transformer
e. Identify the restricted earth fault relay
f. Draw the equivalent circuit of main and backup protection on power transformer

8. Describe the protection scheme of power transformer

You will demonstrate your competence:

- o In the classroom
- o By a written assignment

Your performance will be successful when:

- o Learner will solve the given assignment on time
- o Learner will follow the given procedure in the given assignment
- o Learner will submit the assignment on time

- o Assignment meet the given requirement

Learning Objectives

a. Study principles of distance protection
b. Study principles of Bus Bar protection
c. Identify basic types of distance protection
d. Study the autoreclosure relay and its theory
e. Draw the equivalent circuit of feeder with main and backup protection relays
f. Draw the equivalent circuit of main and backup protection of Bus Bar

9. Describe the protection scheme of Bus-bars and feeders