

COURSE SYLLABUS

EE4040 Power System Protection and Control I

1. Course title: Power System Protection and Control I

2. Course ID: EE4040

3. Credits: 3(3-1-0-6)

- Theory: 45 hours
- Exercise/Assignment: 15 hours

4. Intended attendee: 4th year electrical engineering students

5. Requirement:

- Pre-requisites: Electrical network (EE4010)
- Preparatory: Short-circuit Calculation (EE4020)
- Co-requisites: null

6. Expected Learning Outcomes

The main objective of the course is to provide an overview of the principles and schemes for protecting power lines, transformers, buses and generator. It also provides basic guidelines for relay setting calculation.

Upon successful completion of this course, students will be able to:

- Comprehending basic protection principles in power system
- Applying and analyzing protection schemes for main equipment in power system
- Perform setting calculations for protection relays.

The student will also have increased his/hers abilities to:

- Work independently and in groups,
- Use effectively presentation tools and perform basic teamwork skill.

Contribution to program outcomes:

Outcomes	1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	2.6	3.1	3.2	3.3	4.1	4.2	4.3	4.4	4.5
Level	U	T	T	U	T	I	U	U	T	U	U	I	I	T	T	T	T

7. Course topics:

Main component of protection systems. Protective voltage and current instruments. Protection principles. Protection schemes for main equipment in power system: distribution and transmission lines; power transformers, generators; motors, busbars; capacitor and reactor banks.

8. Textbooks and references:

- Textbooks:
 - Power System Protection, Tran Dinh Long, Science and Technics Publishing House, 2000
 - Power System Automation, Tran Dinh Long, Hanoi University of Science and Technology Publishing House, 2004
- References:
 - Power System Protection, Paul M. Anderson, Wiley-IEEE Press, 1999.
 - Protective Relaying Theory and Applications, Walter A. Elmore, CRC Press, 2003.
 - Power System Relaying, Stanley H. Horowitz, Arun G. Phadke, John Wiley & Sons, 2008.

9. Learning methods and activities:

- Course attendance: in compliance with general regulation
- Exercise/Assignment: complete all assigned homework.

10. Grading plan: Progress (0.3)-Final Exam (TL: 0.7)

Coursework will be weighted as follows:

- Progress evaluation: weighting factor of 0.3
 - At least 6 homework (topic may vary yearly).
- Final written exam: weighting factor of 0.7

11. Tentative Schedule

Week	Topic/Activity	Chapter	Note
1	General phylosophy Requirements for power system protection system Main components of power system protection Needed information for power system protection design	Introduction chapter	
2	Fault and abnormal operating condions of power system	Chapter 1	
3	Specification of main components of power system protection <ul style="list-style-type: none"> • Current transformer • Voltage transformer • Sequence component filter • Auxiliary power supply • Relay • Communication chanel 	Chapter 2	Homework
4	Protection principle utilized in power system: <ul style="list-style-type: none"> • General introduction to protection principle • Overcurent protection 	Chapter 3 3.1, 3.2	
5	<ul style="list-style-type: none"> • Overcurent protection & Under voltage protection • Differential protection 	Chapter 3 3.3,3.4	Homework
6	<ul style="list-style-type: none"> • Phase comparison protection • Under impedance protection 	Chapter 3 3.5, 3.6	
7	<ul style="list-style-type: none"> • Directional overcurent protection • Sequence components of voltage and current • Frequency protection • Other protection principles 	Chapter 3 3.7, 3.8, 3.9, 3.10	Homework
8	Protection of main equipment in power system: <ul style="list-style-type: none"> • Transmission and distribution lines protection <ul style="list-style-type: none"> ○ General introduction ○ Application of overcurrent protection ○ Application of differential protection 	Chapter 4 4.1, 4.2, 4.3	
9	<ul style="list-style-type: none"> ○ Application of distance (under-impedance) protection ○ Directional comparison protection ○ Earth fault protection in un-earthed system 	Chapter 4 4.4, 4.5, 4.6	Homework
10	<ul style="list-style-type: none"> ○ Auto reclose 	Chapter 4 4.7	
11	<ul style="list-style-type: none"> ○ Load shedding 	Chapter 4 4.8	
12	<ul style="list-style-type: none"> • Power transformer protection 	Chapter 4 4.9	Homework

13	<ul style="list-style-type: none">• Busbar protection• Capacitor bank and reactor bank protections	Chapter 4 4.10, 4.11	
14	<ul style="list-style-type: none">• Generator protection	Chapter 4 4.12	Homework
15	<ul style="list-style-type: none">• Motor protection	Chapter 4 4.13	