

TKE213104

Electric Power Systems
Teknik Tenaga Listrik

BASIC INFORMATION

Course Credit	2 / 100 minutes per Week
Course Type	Required
Course Classification	Engineering Topics
Prerequisites	DC and AC Circuits Analysis

STUDENT AND LEARNING OUTCOMES

Covered Student Outcomes

Development of Engineering Solution (KP.2) Engineering Design (KP.3)

Learning Outcomes

- LO1** Students are able to understand the basic components of power systems, namely generators, transmissions, and loads.
- LO2** Students are able to understand the basic operation of power systems.

COURSE DESCRIPTION

The course is a self-contained lecture which introduces the basic operations, i.e. system performance and control and components of power systems, i.e. generators, transmission, distribution, and loads.

TOPICS

1. The Physics of Electricity

- 1.1 Basic Quantities
- 1.2 Ohm's law
- 1.3 Circuit Fundamentals
- 1.4 Resistive Heating
- 1.5 Electric and Magnetic Fields

2. Basic Circuit Analysis

- 2.1 Modeling Circuits
- 2.2 Series and Parallel Circuits
- 2.3 Kirchhoff's Laws
- 2.4 Magnetic Circuits

3. AC Power

- 3.1 Alternating Current and Voltage
- 3.2 Reactance
- 3.3 Power
- 3.4 Phasor Notation

4. Generators

- 4.1 The Simple Generator
- 4.2 The Synchronous Generator
- 4.3 Operational Control of Synchronous Generators
- 4.4 Operating Limits
- 4.5 The Induction Generator
- 4.6 Inverters

5. Loads

- 5.1 Resistive Loads
- 5.2 Motors
- 5.3 Electronic Devices
- 5.4 Load from the System Perspective
- 5.5 Single- and Multiphase Connections

6. Transmission and Distribution

- 6.1 System Structure
- 6.2 Three-Phase Transmission
- 6.3 Transformers
- 6.4 Characteristics of Power Lines
- 6.5 Loading
- 6.6 Voltage Control
- 6.7 Protection

7. Power System Protection

- 7.1 Principal of power system protection
- 7.2 Generator/motor protection
- 7.3 Line protection
- 7.4 Load protection

8. System Performance

- 8.1 Reliability
- 8.2 Security
- 8.3 Stability
- 8.4 Power Quality

9. System Operation, Management, and New Technology

- 9.1 Operation and Control on Different Time Scales
- 9.2 New Technology
- 9.3 Human Factors
- 9.4 Implication for Restructuring

10. The Energy Control Center

10.1 Overview of EMS Functions

10.2 Power Flow Control

10.3 Stability Considerations

10.4 Power System Security

10.5 Contingency Analysis

10.6 Dynamic Security Analysis

REFERENCES

[1] Alexandra Von Meier, Electric Power Systems - A Conceptual Introduction

[2] Mohamed El-Hawary, Introduction to Electrical Power Systems