

**Debre Markos University**

**Debre Markos Institute of Technology**

**Department of Electrical and Computer Engineering**

<b>Program</b>	Regular
<b>Course title</b>	Introduction to Power Systems
<b>Course Code</b>	ECEg3154
<b>Total ECTS</b>	7
<b>Credit hours</b>	3
<b>Target Group:</b>	3 <sup>rd</sup> Year
<b>Year/Semester:</b>	III/II
<b>Pre-requite</b>	Introduction to electrical machines
<b>Instructor</b>	Yayehyirad A. (MSc)

**Course Objectives:**

At the end of this course, students will be able to

- Get familiar with different concepts in electric power systems
- Know how to calculate the parameters(resistance, inductance and capacitance) of any transmission line
- Develop the voltage vs. current relations for any type of transmission line(short, medium length and long line)
- Construct the one line diagram, impedance and reactance diagrams of any power system.

***Chapter1. Introduction***

1.1. Growth of Electric Power Systems

1.2. Development of Electric Power System in Ethiopia

1.3. Power System Focus areas

1.4. The Power system Engineer

1.5. Power System Functional Zones

1.5.1. Generation System

1.5.2. Transmission System

1.5.3. Distribution System

***Chapter 2. Basic Concepts in Electric Power System***

2.1 Power in Single Phase AC Circuits

2.2 Complex power

2.2.1 The Power Triangle

2.3 Direction of Power Flow

2.4 Balanced Three Phase System

2.4.1 Voltage and Current in Balanced Three Phase Circuits

2.4.2 Power in Balanced Three Phase Circuits

2.5 Unbalanced Three Phase System

2.5.1 Voltage and Current in Unbalanced Three Phase Circuits

2.5.2 Power in Unbalanced Three Phase Circuits

2.6 Per-Unit Quantities

***Chapter 3. Physical Aspects of Overhead & Underground Transmission and Distribution System***

3.1 Overhead line

3.1.1 Types of Overhead Line Conductors

3.1.2 Sag and Tension of Lines

3.1.3 Support Structures for Overhead Line

3.1.3.1 Insulators

3.1.3.2 Poles and Towers

3.2 Cable line

3.2.1 Types of Cables

3.2.2 Current Rating of Cables

***Chapter 4.Characteristics and Parameters of Transmission Line***

4.1 Line parameters

4.1.1 Resistance

4.1.2 Inductance

4.1.3 Capacitance

4.1.4 Corona Incidence & losses

4.1.5 Skin and proximity effect

***Chapter 5.Current and Voltage Relations on a Transmission Line***

5.1 Introduction

5.2 Representation of line

5.2.1 The short transmission line

5.2.2 The medium-length transmission line

5.2.3 The long transmission line

5.2.4 Transient behavior of long transmission line

5.2.5 Surge impedance loading

5.2.6 Calculation of efficiency and voltage regulation for transmission lines

5.2.7 Ferranti Effect

5.2.8 Voltage control techniques in a transmission line

5.3 Power flow through transmission line

5.4 Direct current transmission.

***Chapter 6.Power System Modeling***

6.1 The Circuit Model of Synchronous Machine

- 6.2 The circuit Model of Transformer
  - 6.2.1 Ideal transformer
  - 6.2.2 Practical transformer
- 6.3 The One Line Diagram
- 6.4 Impedance and reactance diagrams

### **References**

1. William D.Stevenson, Jr., *Elements of Power system Analysis*, 4<sup>th</sup> edition, McGraw-Hill, 1982.
2. John Grainger(Author), Jr., *Power System Analysis*, McGraw-Hill ,1<sup>st</sup>edition,1994
3. Mohammed E.EL-Hawarya, *Electrical Power System: Design and Analysis*, Revised Printing, John Willey&Sons Inc., 1995.
4. Ashfaq Husain, *Electrical Power Systems*, 5th edition, CBS Publishers,2007.
5. Syed A. Nasar, *Electrical Power Systems (Schaum's Outline Series)*, McGraw-Hill, 2004.
6. C. L. Wadhwa, *Electrical Power Systems*, New Age International publishers, 2004.
7. Alexandra von Meier, *Electrical Power System-A conceptual Introduction*, Wiley-IEEE press, 2006.
8. Arthur R. Bergen, *Power Systems Analysis*, 2<sup>nd</sup> edition, prentice Hall, 1999.
9. Dr.George G. Karady, Dr. Keith E. Holbert, *Electrical Energy Conversion and Transport-An Interactive Computer-Based Approach*, wiley-IEEE Press, 2005.