Birzeit University
Faculty of Engineering and Technology
Department of Electrical and Computer Engineering
ENEE 4403

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Course Objectives:

This course is designed to provide students with an understanding of:

- The integrated power system including generation, transmission, and distribution of electric power.
- Solution methods for the flow of power and to obtain the operating points of a multi-node power system, including optimal economic operation.
- Methods for calculating fault currents for balanced and unbalanced network faults.

Textbooks:

- J. Duncan Glover, Mulukutla S. Sarma and Thomas J. Overbye, "Power System Analysis and Design," Cengage Learning, Sixth Edition, 2017.
- H. Saadat, Power System Analysis, 2nd edition, McGraw-Hill (2002).

Intended Learning Outcomes (ILO's):

After completing the course, the students should be able to do the following:

1. Apply concepts from basic electromagnetic to determine the inductance, capacitance, and resistance of three phase transmission lines, including lines with conductor bundling.
2. Be able to do basic design of transmission lines to specified parameters.
3. Be able to derive the relationships between the voltage and current on a transmission line, and be able to use hyperbolic functions to solve for the voltage or current at any point along the line.
4. Be able to derive the equivalent model for a transmission line and then use this model to calculate the power flow through a transmission line.
5. Know the limits affecting the maximum amount of power that can be transferred through a transmission line.
6. Know how to build the bus-impedance and the bus-admittance matrices for power system networks and use Matlab to solve basic power system problems.
7. Know how to perform a power flow analysis for a small network, compute the elements of the Jacobian matrix, and find the bus voltages and angles.
8. Know how to solve optimal power flow problems.

9. Know how to perform a fault analysis for a small network, use symmetrical components to solve fault problems, and calculate the short-circuit currents for a three-phase fault, line-to-line fault, double-line-to-ground fault, and single-line-to-ground fault.
10. Know the basics of system protection, including the common protection schemes.

Exams and Grades:

First and Second Exams	40%
Simulation Project	15%
Assignments	10%
Final Exam	35%

Simulation Assignments

MATLAB and PowerWorld simulation assignments are required in this course. This will be giving students the opportunity to learn how to use these programs to analyze and design power system networks.

Course Contents:

- **Introduction and General Concepts.**
- **Power System: An Overview.**
- **Transmission Line (TL) Parameters.**
- **Transmission Line Modeling and Performance.**
- **Power system Network Arrangements.**
- **Power Flow Analysis.**
- **Optimal Dispatch of Generation.**
- **Balanced Faults.**
- **Symmetrical Components and Unbalanced Faults.**
- **Introduction to Power System Protection.**

References:

1. J. Grainger & W. Stevenson, Power System Analysis, McGraw-Hill (1994).

2. P. P. Deo, Power system analysis, First Edition, Technical Publications Pune, (2007).
3. I. J. Nagrath, Modern power system analysis, McGraw-Hill (1989).

4. Charles A. Gross, Power system analysis, John Wiley and Sons (1986).

5. L. Hewitson, M. Brown, and R. Balakrishnan, Practical Power system Protection, IDC Technologies (2005).