

# ECE 461/462: Power Systems/Lab

IN

OUT

## Calculus and Algebra

- Work with complex numbers
- Understand elementary calculus

## Circuit Theory

- Understand AC circuit theory and use of phasors
- Operate with vectors in all coordinate systems

## Fields

- Understand electric and magnetic fields
- Use Coulomb and Gauss law to calculate electrostatic fields surrounding wires conducting AC current at arbitrary voltages
- Understand the lumped parameter approximations for L-R-C
- Understand magnetic fields and forces

## Pre-requisites

- ECE 332 with a C or higher

## Concepts:

- Single and three phase electric and magnetic fields
- Maxwell's equations in integral and differential form to calculate transmission line inductances and capacitances
- Three phase circuit analysis
- The role of the P-Q-S triangle in conventional and alternative power systems
- Explore the use of PSSE software in computer laboratory experiments
- Learn the concepts of per unit analysis
- Overview of DC, AC and PMAC motors with associated power Electronics drives

## Applications:

- Employing PSSE to calculate power system flow, stability and loading
- Charge and current density in conductors with different geometries
- Wave propagation in free space for transmission lines
- Magnetic circuits in transformers

## Tools:

- Calculus for solution of analytical AC circuits
- Complex algebra
- PSSE software

## Three-Phase Circuits

- Analyze and determine V-I in phasor form at various points in a complex power system in both absolute and per unit
- Understand the methods to change per unit specifications of rated equipment into the operational values
- Determine capacitance, inductance, and resistance of transmission lines
- Identify and model AC three-phase circuits that include motors, generators, and connective lines in a complex industrial load
- Lab experience with power electronic motor drives

## Future Alternative Energies

- Understand geothermal heat and hydro power generation possibilities
- Understand Wave and tidal power generation possibilities
- Understand the role of heat pipes in modern HVAC systems
- Understand recycling as a form of energy conservation