EE-4222
Power Systems Analysis 2

Curricular Designation: EE: elective  
CpE: N/A

Catalog Description:
EE 4222 – Power systems analysis 1 Topics covered include symmetrical components; symmetrical faults; unbalanced faults; generating the bus impedance matrix and using it in fault studies; power system protection; power system operation; power system stability. Credits: 3.0  Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: EE4221

Textbooks(s) and/or Other Required Materials:

Prerequisites by Topic:
1. Prerequisite topics of EE4221.
2. Mastery of 60 Hz models of transmission lines, loads, and transformers, particularly the per unit models.
3. Mastery of the per unit system.

Course Objectives:
1. Mastery of balanced and unbalanced faults, including fault calculations using bus impedance matrices.
2. Familiarity with generation of positive, negative, and zero sequence bus impedance matrices.
3. Mastery of symmetrical component representation of power system components and their application to unbalanced faults.
4. Familiarity with overcurrent, differential, and ratio protection devices and their application in a coordinated protection scheme.
5. Familiarity with power system operation, including power flow, economic dispatch of generation, frequency and voltage control.
6. Familiarity with stability problems and clearing of faults to mitigate these problems; the ability to calculate critical clearing times.

Topics Covered:
2. Unbalanced three-phase short-circuits, including: Developing sequence networks for power systems, Developing sequence impedance matrices for power systems from the sequence networks, Applying sequence networks and sequence impedance matrices to determine the system., currents and voltages under the application of unbalanced faults, Selecting fuses and circuit breakers in power systems.
3. **Power system protection**, including: instrument transformers, CTs and VTs., overcurrent, directional, impedance, and differential relays; fuses and reclosers, coordination of overcurrent devices, protecting lines, buses, and transformers.

4. **Control of power system operation**: power flow, scheduling generation, including the statistical nature of load, generator-voltage control, turbine-governor control, economic dispatch, including losses.

5. **Power system stability**: the swing equation, equal-area criterion, solution of the swing equation, design methods for improving stability

### Relationship of the Course Content to Program Outcomes:

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<thead>
<tr>
<th>Outcome</th>
<th>Topics and Level of Coverage</th>
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<tbody>
<tr>
<td><strong>a</strong></td>
<td>an ability to apply knowledge of mathematics, science and engineering</td>
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<td><strong>b</strong></td>
<td>an ability to design and conduct experiments, as well as to analyze and interpret data</td>
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<td><strong>c</strong></td>
<td>the ability to design a system, component, or process to meet desired needs within realistic constraints such as...</td>
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<td><strong>d</strong></td>
<td>an ability to function on multi-disciplinary teams</td>
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<td><strong>e</strong></td>
<td>an ability to identify, formulate and solve engineering problems</td>
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<tr>
<td><strong>f</strong></td>
<td>an understanding of professional and ethical responsibility</td>
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<td><strong>g</strong></td>
<td>an ability to communicate effectively</td>
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<tr>
<td><strong>h</strong></td>
<td>the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context</td>
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<td><strong>i</strong></td>
<td>a recognition of the need for, and an ability to engage in life-long learning</td>
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<td><strong>j</strong></td>
<td>a knowledge of contemporary issues</td>
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<td><strong>k</strong></td>
<td>the ability to use the techniques, skills, and modern engineering tools necessary for the practice of electrical engineering</td>
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### Contribution of Course to Meeting Degree Requirements:
3 Credit Hours – Engineering Topics

### Class/Laboratory Schedule (note: 1 hour = 50 minutes):
Lecture: 42 hours = 3 hours/week for 14 weeks

### Prepared by:
Dennis Wiitanen, Professor, March 10, 2010