Course Objectives
Modeling of power transmission systems, and introduction of computational methods for solving problems such as load flow, faults, and stability analysis.

Prerequisites
ECE 3650 Electric Machines

Course Content
The following topics will be covered:

- Introduction to the main elements of a power system (power generation, transmission, and distribution) and the concepts of protection, operation and control.
- Review of basic concepts and machine models (three phase systems, per unit system, transformer and generator models).
- Power transmission line models and performance (calculation of line constants, two port models of transmission lines, line compensation design)
- Power flow analysis (Gauss-Seidel, Newton-Raphson and decoupled power flow)
- Fault analysis (symmetrical faults, short circuit capacity, symmetrical components, asymmetrical faults)
- Power system stability (swing equation, equal area criterion)

Accreditation Units
Mathematics: 0%
Natural Science: 0%
Complementary Studies: 0%
Engineering Science: 100%
Engineering Design: 0%

Web Page
http://ece.eng.umanitoba.ca/undergraduate/ECE4300

Textbook

Evaluation Details
The final course grade will be determined from a student's performance on assignments, in laboratories, and on examinations. Calculators and one 8.5 x 11 page of hand-written notes (one side only) will be allowed on examinations. Students must complete all the laboratories in order to be eligible to receive a passing grade.

Mid-Terms
Wednesday, October 8, 2014, 6:30-8:30 PM (location TBA)
Wednesday, November 5, 2014, 6:30-8:30 PM (location TBA)

Instructor
Prof. Athula Rajapakse
Room: Stanley Pauley Centre 307
Telephone: (204) 480-1403
Email: Athula.Rajapakse@umanitoba.ca
Office Hours
Tuesdays and Thursdays, 10:30 AM - 2:00 PM, or by appointment.

Teaching Assistants
TBA

Voluntary Withdrawal Date
Wednesday, November 12th, 2014.

Requirements/Regulations
- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with Sections 4 and 6 of the Regulations dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.

Academic Integrity
Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations and Requirements of the University of Manitoba, Section 7.1, students are reminded that plagiarism or any other form of cheating in examinations, assignments, laboratory reports or term tests is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty.

Learning Outcomes
1. Recognize the structure and operation of electricity generation, transmission and distribution systems and its impact on the society and environment.
2. Solve problems involving modeling, design and performance evaluation of power transmission lines.
3. Analyze power flow in power transmission networks and apply power flow results to solve simple planning problems.
4. Calculate currents and voltages in a faulted power system under both symmetrical and asymmetrical faults, and relate fault currents to circuit breaker ratings.
5. Analyze the transient stability of simple power systems using equal area criterion.

Expected Competency Level **

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>A6</th>
<th>A7</th>
<th>A8</th>
<th>A9</th>
<th>A10</th>
<th>A11</th>
<th>A12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
*Attributes:
A1 A knowledge base for engineering
A2 Problem analysis
A3 Investigation
A4 Design
A5 Use of engineering tools
A6 Individual and team work
A7 Communication skills
A8 Professionalism
A9 Impact of engineering on society/environment
A10 Ethics and equity
A11 Economics and project management
A12 Life-long learning

**Competency Levels:**
1 - Knowledge (Able to recall information)
2 - Comprehension (Able to rephrase information)
3 - Application (Able to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships)
5 - Synthesis (Able to combine separate elements into whole)
6 - Evaluation (Able to judge of the worth of something)

Student Contact Time (Hrs)
- **Lectures:** 3 hrs lecture/week × 13 weeks/term = 39 hrs
- **Laboratories:** 3 hrs laboratory × 5 weeks = 15 hrs
- **Tutorials:** 3 hr tutorial × 2 weeks = 6 hrs

Evaluation

<table>
<thead>
<tr>
<th>Component</th>
<th>Value (%)</th>
<th>Methods of Feedback *</th>
<th>Learning Outcomes Evaluated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
<td>10</td>
<td>F, S</td>
<td>2, 3, 4, 5</td>
</tr>
<tr>
<td>Laboritories</td>
<td>10</td>
<td>F, S</td>
<td>2, 3, 4, 5</td>
</tr>
<tr>
<td>Mid-Term Tests</td>
<td>30</td>
<td>F, S</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>Final Examination</td>
<td>50</td>
<td>S</td>
<td>1, 2, 3, 4, 5</td>
</tr>
</tbody>
</table>

* Methods of Feedback:  F - formative (written comments and/or oral discussion), S - summative (number grades)