IMPORTANT NOTICE – Mandatory Requirement to Report

This course will be conducted using remote instruction. Students who are accessing the course from outside of Canada or the USA must notify the instructor and indicate in which country they are located. Access to software may be restricted from some countries and failure to comply with these restrictions may result in criminal prosecution.

Course Objectives

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

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).

Textbook


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 on Academic Integrity*, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student 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 and operation 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 Levels

| Outcome | KB | PA | IN | DE | ET | IT | CS | PR | IE | EE | EP | LL |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1       | 3  | 1  |    |    |    | 1  |    |    | 3  |    |    |    | 3  |
| 2       | 5  | 4  | 3  | 3  | 4  |    |    |    | 1  |    |    |    | 1  |
| 3       | 5  | 4  | 3  | 3  | 4  |    |    |    | 1  |    |    |    | 1  |
| 4       | 5  | 4  | 3  | 3  | 4  |    |    |    | 1  |    |    |    | 1  |
| 5       | 4  | 4  | 3  | 3  | 1  |    |    |    |    |    |    |    | 1  |

Evaluation

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.

Component | Value (%) | Method of Feedback | Learning Outcomes Evaluated
--- | --- | --- | ---
Assignments | 15 | F, S | 1, 2, 3, 4, 5
Laboratories | 10 | F, S | 2, 3, 4, 5
Term Tests (2) * | 35 | F, S | 1, 2, 3, 4
Final Examination | 40 | S | 1, 2, 3, 4, 5

* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)
❖ The better of two tests will be weighted at 20%, while the other will be weighted at 15%

CEAB Graduate Attributes Assessed

PA.3 – Analyzes and solves complex engineering problems.

IE.1 – Understands the social, environmental, economic, health, safety and/or cultural aspects of engineering activities.

Copyright Notice

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Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University’s Intellectual Property Policy and the protection of privacy provisions of The Freedom of Information and Protection of Privacy Act (Manitoba). Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.
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 the University’s General Academic Regulations, as well as Section 3 of the Faculty of Engineering Academic 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.

- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

Grading Scale

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<thead>
<tr>
<th>Letter</th>
<th>Mark</th>
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<tbody>
<tr>
<td>A+</td>
<td>95–100</td>
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<tr>
<td>A</td>
<td>85–94</td>
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<tr>
<td>B+</td>
<td>80–84</td>
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<tr>
<td>B</td>
<td>70–79</td>
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<td>C+</td>
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<tr>
<td>D</td>
<td>45–54</td>
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<tr>
<td>F</td>
<td>&lt; 45</td>
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Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.