CALCULATION/COURSE DESCRIPTION

Elements of generation, transmission, and distribution systems; system-wide energy flow and control; modelling and simulation; economics and management; fault prediction and management.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in level III or greater in Computer or Electrical Engineering; ELECENG 3PI4.

SCHEDULE

Format: 3 lectures and 1 tutorial per week; 4 quizzes; 1 written assignment (North American grid network), 6 laboratories studying the modelling of electrical power networks, and final end exam.

Lectures: Room T13 127: Monday 11:30am – 12:20pm; Wednesday 11:30am – 12:20pm; Friday 1:30pm – 2:20pm
Tutorial: Room T13 127: Monday 12:30 pm – 1:20 pm
Labs: Room ITB 234. Every Other Week: L01 Monday 2:30 pm - 5:20 pm ; L02 Monday 2:30 pm - 5:20 pm ; L03 Tuesday 2:30 pm - 5:20 pm ; L04 Tuesday 2:30 pm - 5:20 pm ; L05 Wednesday 2:30 pm - 5:20 pm ; L06 Wednesday 2:30 pm - 5:20 pm

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Nan Zhao
ITB-A310
Zhaon5@mcmaster.ca
ext. 21995
Office Hours: by appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Peter Azer
MARC Building
eliap@mcmaster.ca

Zipan Nie
ITB-A202
niez4@mcmaster.ca

Mackenzie Wootton
MARC Building
woottomj@mcmaster.ca
Office Hours: by appointment

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

http://avenue.mcmaster.ca/
COURSE OBJECTIVES

To gain an appreciation of the main elements of a large electrical power system from the generation plant, to distance transmission and local distribution to consumers, to the final supply and cost regimes for electrical energy. The design and performance of large power supply networks and the characteristics and specifications of the main items of equipment involved will be studied and analysis techniques, network modelling and simulation tools will be developed and used to study local and system wide energy flow and control to gain an appreciation of system economics and management, and to perform fault calculations and study protection schemes.

Specific objectives will be to:

• have an understanding of the various conventional and renewable methods of power generation.
• use equivalent network models to calculate real power flow and understand the VAr demands on power system performance.
• analyse balanced and unbalanced three-phase, three and four wire networks.
• analyse the steady state behaviour of synchronous and induction generators and determine their main control features and performance characteristics when connected to large power networks.
• study the per-unit-system with regard to power system analysis and component specification, and calculating fault levels for balanced three-phase conditions.
• understand the construction and calculate the performance of three phase transformers and inductors in power systems.

INTENDED LEARNING OUTCOMES

<table>
<thead>
<tr>
<th>Category of outcome</th>
<th>Students should be able to:</th>
<th>Assessment measure</th>
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</thead>
</table>
| Knowledge and understanding | • Understand the basic concepts of electrical power generation, transmission, distribution, faults and protection.  
• Understand the importance of component and system operation and impacts of steady load flow.  
• Understand steady-state models for electric machines, transmission lines, transformers and loads.  
• Understand the simplifying assumptions encompassed by the models and hence model appropriateness. | Labs., Quizzes and final exam. |
| Intellectual skills | • Analyse and interpret electrical component models, parameters and how design impacts on their variability.  
• Translate application demands to simple design specifications. | Labs., Quizzes and final exam. |
| Practical skills | • Simulate the operation of electrical power systems, interpretation of results, and validation via analytic test cases. | Labs., Quizzes and final exam. |
| Transferable skills and personal qualities | • Perform literature search; scientific report writing; generalisation of subject core.  
• Plan and undertake learning activities based on the module resources. | Assignment. |
COURSE MATERIALS

RECOMMENDED TEXTBOOK

RECOMMENDED READING

Calculator:
Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

ASSESSMENT

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Quiz solutions (4 x 5%)</td>
<td>20%</td>
</tr>
<tr>
<td>Assignment</td>
<td>10%</td>
</tr>
<tr>
<td>Laboratories (6 x 5%)</td>
<td>30%</td>
</tr>
<tr>
<td>Final Exam (2.5 hours)</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

ACCREDITATION LEARNING OUTCOMES

Note: The Learning Outcomes defined in this section are measured throughout the course and form part of the Department's continuous improvement process. They are a key component of the accreditation process for the program and will not be taken into consideration in determining a student’s actual grade in the course. For more information on accreditation, please ask your instructor or visit: [http://www.engineerscanada.ca](http://www.engineerscanada.ca).

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Indicators</th>
<th>Measurement Methods(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual and Team Work</td>
<td>6.3</td>
<td>Laboratories 1 to 6, equally spaced through duration of course. Laboratory groups of 3 to 4 members. Complete laboratory tasks as a group, discussing and solving the posed problems and appropriately documenting via an individual report. Leadership role managed via TA stewardship.</td>
</tr>
<tr>
<td>Shows an awareness of the PEO and the role of licensing.</td>
<td>8.3</td>
<td>In class discussions relating to specific application examples of system faults, protection of equipment and personnel, the management of Health and Safety in electrical power systems and the role of professional organizations to underpin engineering quality in this aspect. Understanding of concept ideas and role of PEO and licensing.</td>
</tr>
<tr>
<td>Impact of Engineering on Society and the Environment</td>
<td>9.1</td>
<td>The course assignment aims to familiarize students with the structure and size of a national electrical generation, transmission, distribution and utilization industry such that they may be more informed of the key details, issues and policy surrounding the industry. The student has to report on the Canadian system and the USA or their own national system. The study progresses from the historical development to current day practice and future projections, thus the short-term, long-term, local and global impacts of the electrical power industry on society is discussed and assessed. Students produce a report of their findings from which the rubric specifics are assessed.</td>
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</tbody>
</table>

**ACADEMIC INTEGRITY**

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.
**ACADEMIC ACCOMMODATIONS**

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University’s Policy for Academic Accommodation of Students with Disabilities.

**NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK**

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work": http://www.mcmaster.ca/msaf/

**NOTICE REGARDING POSSIBLE COURSE MODIFICATION**

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

**REFERENCE TO RESEARCH ETHICS**

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf.
Information for Laboratory Safety and Important Contacts

This document is for users of ECE instructional laboratories in the Information Technology Building.

This document provides important information for the healthy and safe operation of ECE instructional laboratories. This document is required reading for all laboratory supervisors, instructors, researchers, staff, and students working in or managing instructional laboratories in ECE. It is expected that revisions and updates to this document will be done continually. A McMaster University lab manual is also available to read in every laboratory.

General Health and Safety Principles

Good laboratory practice requires that every laboratory worker and supervisor observe the following:
1. Food and beverages are not permitted in the instructional laboratories.
2. A Laboratory Information Sheet on each lab door identifying potential hazards and emergency contact names should be known.
3. Laboratory equipment should only be used for its designed purpose.
4. Proper and safe use of lab equipment should be known before using it.
5. The course TA leading the lab should be informed of any unsafe condition.
6. The location and correct use of all available safety equipment should be known.
7. Potential hazards and appropriate safety precautions should be determined, and sufficiency of existing safety equipment should be confirmed before beginning new operations.
8. Proper waste disposal procedures should be followed.

Location of Safety Equipment

<table>
<thead>
<tr>
<th>Fire Extinguisher</th>
<th>First Aid Kit</th>
</tr>
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<tbody>
<tr>
<td>On walls in halls outside of labs</td>
<td>ITB A111, or dial “88” after 4:30 p.m.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Telephone</th>
<th>Fire Alarm Pulls</th>
</tr>
</thead>
<tbody>
<tr>
<td>On the wall of every lab near the door</td>
<td>Near all building exit doors on all floors</td>
</tr>
</tbody>
</table>
In Case of a Fire (Dial 88)
When calling to report a fire, give name, exact location, and building.
1. Immediately vacate the building via the nearest Exit Route. Do not use elevators!
2. Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.
3. The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself!
4. In the event of a fire in your work area shout “Fire!” and pull the nearest fire alarm.
5. Do not attempt to extinguish a fire unless you are confident it can be done in a prompt and safe manner utilizing a hand-held fire extinguisher. Use the appropriate fire extinguisher for the specific type of fire. Most labs are equipped with Class A, B, and C extinguishers. Do not attempt to extinguish Class D fires which involve combustible metals such as magnesium, titanium, sodium, potassium, zirconium, lithium, and any other finely divided metals which are oxidizable. Use a fire sand bucket for Class D fires.
6. Do not attempt to fight a major fire on your own.
7. If possible, make sure the room is evacuated; close but do not lock the door and safely exit the building.

Clothing on Fire
Do not use a fire extinguisher on people
1. Douse with water from safety shower immediately or
2. Roll on floor and scream for help or
3. Wrap with fire blanket to smother flame (a coat or other nonflammable fiber may be used if blanket is unavailable). Do not wrap a standing person; rather, lay the victim down to extinguish the fire. The blanket should be removed once the fire is out to disperse the heat.

Who to Contact

Non-Emergency Accident or Incident: Immediately inform the TA on duty or Course Instructor.
University Security (Enquiries / Non-Emergency): Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.
See TA or Instructor: For problems with heat, ventilation, fire extinguishers, or immediate repairs
Environmental & Occupational Health Support Services (EOHSS): For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.
ECE Specific Instructional Laboratory Concerns: For non-emergency questions specific to the ECE
Equipment Failure or Hazard
Failure of equipment may be indicative of a safety hazard - You must report all incidents.
Should you observe excessive heat, excessive noise, damage, and/or abnormal behaviour of the lab equipment:
1. Immediately discontinue use of the equipment.
2. In Power Lab, press wall-mounted emergency shut-off button.
3. Inform your TA of the problem.
4. Wait for further instructions from your TA.
5. TA must file an incident report.

Protocol for Safe Laboratory Practice
Leave equipment in a safe state for the next person - if you’re not sure, ask!
In general, leave equipment in a safe state when you finish with it. When in doubt, consult the course TA.

Defined Roles
<table>
<thead>
<tr>
<th>Role</th>
<th>Contact Information</th>
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<tbody>
<tr>
<td>TA</td>
<td>The first point of contact for lab supervision</td>
</tr>
<tr>
<td>ECE Lab Supervisor</td>
<td>Steve Spencer- ITB 147</td>
</tr>
<tr>
<td>ECE Chair</td>
<td>Tim Davidson- ITB A111</td>
</tr>
<tr>
<td>ECE Administrator</td>
<td>Kerri Hastings- ITB A111</td>
</tr>
<tr>
<td>ECE Course Instructor</td>
<td>Please contact your specific course instructor directly</td>
</tr>
</tbody>
</table>