

## Course Outline

### 1. COURSE INFORMATION

<b>Session Offered</b>	Fall 2023
<b>Course Name</b>	Computer Applications in Power System Engineering
<b>Course Code</b>	ENRTECH 4CA3
<b>Date(s) and Time(s) of lectures</b>	Wednesdays, 6:30 pm – 9:30 pm
<b>Program Name</b>	Power and Energy Engineering Technology
<b>Calendar Description</b>	Analysis of load flow, short circuit, transient stability, and electromagnetic transients by commercial power system software packages.
<b>Instructor(s)</b>	Dr. Chi Tang, P. Eng.      E-Mail: cktang@mcmaster.ca Office Hours & Location: 4 pm to 10 pm, ETB 214

### 2. COURSE SPECIFICS

<b>Course Description</b>			
<b>Instruction Type</b>	<b>Code</b>	<b>Type</b>	<b>Hours per term</b>
	C	Classroom instruction	39
	L	Laboratory, workshop or fieldwork	
	T	Tutorial	
	DE	Distance education	
	<b>Total Hours</b>		39
<b>Resources</b>	<b>ISBN</b>	<b>Textbook Title &amp; Edition</b>	<b>Author &amp; Publisher</b>
	ISBN:	Ref. 1 EPRI Power Systems Dynamics Tutorial	EPRI, Palo Alto, CA: 2009. 1016042
		Ref. 2 Ontario Resource and Transmission Assessment Criteria	IESO, Issue 5.0
		Ref. 3 PSSE Program Application Guide Volumes 1 &2	Siemens PTI
		Ref. 4 PSSE Program Operation Manual	Siemens PTI
		Ref. 5 EMTP-RV Get-Started Training Manual	Powersys
	<b>Other Supplies</b>	<b>Source</b>	
	PSSE Software	Siemens PTI	
<b>Prerequisite(s)</b>	ENGTECH 4CT3, ENRTECH 4PD3, ENRTECH 4PM3, one of ENRTECH 4RG3, ENRTECH 4RT3 and ENRTECH 4RE3, and registration in Power and Energy Engineering Technology		

<b>Corequisite(s)</b>		
<b>Antirequisite(s)</b>		
<b>Course Specific Policies</b>		
<b>Departmental Policies</b>	<p>Students must maintain a GPA of 3.5/12 to continue in the program.</p> <p>In order to achieve the required learning objectives, on average, B.Tech. students can expect to do at least 3 hours of “out-of-class” work for every scheduled hour in class. “Out-of-class” work includes reading, research, assignments and preparation for tests and examinations.</p> <p>Where group work is indicated in the course outline, such collaborative work is mandatory.</p> <p>The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception.</p> <p>Announcements made in class or placed on Avenue are considered to have been communicated to all students including those individuals that are not in class.</p> <p>Instructor has the right to submit work to software to identify plagiarism.</p>	
<b>3. SUB TOPIC(S)</b>		
Week 1	<p><b>Course Introduction</b></p> <ul style="list-style-type: none"> <li>o Introduction to Ontario transmission grid</li> <li>o Power system operation and planning</li> <li>o Different types of power system analysis</li> <li>o Power system analytical tools</li> </ul>	<p>Ref. 1 - Ch. 1 &amp; 2</p> <p>Ref. 2 – Ch. 2</p>
Week 2	<p><b>Steady State Simulations – Part 1</b></p> <ul style="list-style-type: none"> <li>o Thermal Overload Studies</li> <li>o Linear load flow</li> <li>o Case study #1: Flow into GTA</li> </ul>	<p>Ref. 3 – Sections on DCLF, DFAX, TLTG</p>
Week 3	<p><b>Steady State Simulations – Part 2</b></p> <ul style="list-style-type: none"> <li>o AC load flow analysis</li> <li>o Voltage decline studies</li> <li>o Voltage stability studies – PV and QV curves</li> </ul>	<p>Ref. 3: Sections on Power System Network Simulations and Basic Power Flow Activity Applications</p>
Week 4	<p><b>Steady State Simulations – Part 3</b></p> <ul style="list-style-type: none"> <li>o Case study #2: Flow into Ottawa</li> </ul>	<p>Ref. 2 – Ch. 4</p>

Week 5	<b>Short Circuit Calculations</b> <ul style="list-style-type: none"> <li>o Breaker duty calculations</li> <li>o Simulation of asymmetrical faults (SLG, LLG) in transient stability analysis</li> <li>o Case Study #3: Short circuit levels at major generating stations in Ontario</li> </ul>	Ref. 3 - Section on Fault Analysis
Week 6	<b>Reading Week</b>	
Week 7	<b>Introduction to Term Project</b> <ul style="list-style-type: none"> <li>o Transmission expansion plan to accommodate new generation in remote northern Ontario</li> </ul>	Ref. 4
Week 8	<b>Transient Stability Simulations – Part 1</b> <ul style="list-style-type: none"> <li>o Dynamic modelling of synchronous generators</li> <li>o Dynamic modelling of renewable energy resources</li> <li>o Transient stability analysis procedure</li> </ul>	Ref. 3
Week 9	<b>Transient Stability Simulations – Part 2</b> <ul style="list-style-type: none"> <li>o Case Study #4: Flow Away from Bruce</li> </ul>	Ref. 2 – Ch. 4
Week 10	<b>Electromagnetic Transient Simulations – Part 1</b> <ul style="list-style-type: none"> <li>o Introduction to EMTP-RV</li> </ul>	Ref. 5
Week 11	<b>Electromagnetic Transient Simulations – Part 2</b> <ul style="list-style-type: none"> <li>o Capacitor switching</li> </ul>	Ref. 5
Week 12	<b>Review of Term Project – Part 1</b> <ul style="list-style-type: none"> <li>o Linear and AC load flow analysis</li> </ul>	
Week 13	<b>Review of Term Project – Part 2</b> <ul style="list-style-type: none"> <li>o Transient stability analysis</li> </ul>	
Week 14	<b>Course Review</b>	
Midterm Recess: Monday, October 9 to Sunday, October 15 Classes end: Wednesday, December 6		

Final examination period: Friday, December 8 to Thursday, December 21  
 All examinations MUST be written during the scheduled examination period

**List of experiments**

Lab 1	
Lab 2	
Lab 3	
Lab 4	
Lab 5	
Lab 6	
Lab 7	
Lab 8	
Lab 9	
Lab 10	
Lab 11	
Lab 12	

Note that this structure represents a plan and is subject to adjustment term by term. The instructor and the 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.

<b>4. ASSESSMENT OF LEARNING *including dates*</b>	<b>Weight</b>
Assignments	30
Term Project	40
Final examination (tests cumulative knowledge)	30
<b>TOTAL</b>	<b>100%</b>

Percentage grades will be converted to letter grades and grade points per the University calendar.

**5. LEARNING OUTCOMES**

1. Understand the operating characteristics of the Ontario transmission grid.
2. Understand the different types of transmission system operating constraints.
3. Perform large scale load flow analysis of the Ontario transmission grid using PSS/e.
4. Perform multi-machine transient stability analysis using PSS/e.
5. Perform large scale fault analysis of the Ontario transmission grid using PSS/e.
6. Understand the NERC/IESO criteria for deriving operating security limits.
7. Learn how to design transmission system expansion plans.

**6. COURSE OUTLINE – APPROVED ADVISORY STATEMENTS**

**ANTI-DISCRIMINATION**

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.

[http://www.mcmaster.ca/policy/General/HR/Discrimination\\_Harassment\\_Sexual\\_Harassment-Prevention&Response.pdf](http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf)

### **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. It is your responsibility to understand what constitutes academic dishonesty.

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. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>

The following illustrates only three forms of academic dishonesty: The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

### **AUTHENTICITY / PLAGIARISM DETECTION**

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com, please go to [www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity).

### **COURSES WITH AN ON-LINE ELEMENT**

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

### **ONLINE PROCTORING**

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

### **COMMUNICATIONS**

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their @mcmaster.ca alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

### **CONDUCT EXPECTATIONS**

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

### **ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES**

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

### **REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK**

McMaster Student Absence Form (MSAF): 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".

### **ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)**

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests. <http://www.mcmaster.ca/policy/Students-AcademicStudies/Studentcode.pdf>

### **COPYRIGHT AND RECORDING**

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

### **EXTREME CIRCUMSTANCES**

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.