

Course Outline

1. COURSE INFORMATION

Session Offered	WINTER 2017	
Course Name	Power Systems Quality	
Course Code	ENRTECH 4PQ3	
Program Name	B. Tech.	
Calendar Description	Wednesday, January 4, 2017 to Thursday, April 6, 2017	
Instructor	Dr. Michael D.N. Dang	Telephone: 647 -462-8179 E-Mail: mdmikedang@hotmail.com Office Hours & Location: 6:30 p.m. to 9:30 p.m.; Room ETB 230

2. COURSE SPECIFICS

Course Description	Poor power quality can risk disruption to production processes and damage to sensitive equipment. This course is designed to cover key components in power quality including power quality measurements and problems that can arise from harmonics and voltage fluctuations. It also updates students on current power quality standards, the usual cause and effects of power disturbances and how to resolve them.		
Instruction Type	Code	Type	Total Hours
	C	Classroom Instruction	30
	L	Laboratory, workshop or fieldwork	3
	T	Tutorial	3
	DE	Distance Education	
	TOTAL HOURS		36
Resources	ISBN	Textbook Title & Edition	Author & Publisher
	ISBN-10: 0071761551 ISBN-13: 978-0071761550 Edition: 3	Electrical Power Systems Quality <u>Note:</u> For reference only. Some topics are from published papers.	Roger C. Dugan: McGraw-Hill Companies, Inc., January 2012
	Other Supplies		
Prerequisite(s)	3EP3 , 3MA3		
Corequisite(s)	NA		
Antirequisite(s)	NA		
Course Specific Policies	<p>1) The instructor reserves the right to choose the format of any deferred midterms or deferred final exams (i.e. format may be written or oral).</p> <p>2) Please note that announcements concerning any types of graded material may be in any format (e.g., announcements may be made only in class). Students are responsible for completing the graded material regardless of whether they received the announcement or not.</p>		

Departmental Policies	<p>Students must maintain a 3.5/12 GPA to continue in the program. 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>	
3. SUB TOPIC(S)		
Week 1	Introduction to Power Quality: Definition; Variation to the AC voltage waveforms; importance of good power quality; consequences of poor power quality; Most common power quality problems; power quality Standards.	Chapter 1
Week 2	Voltage Sags and Swells: Definition; Voltage sags in power systems, sources and sensitivity; causes and effects of voltage swells, measurement and assessment of flickers; Guidelines.	Chapter 2
Week 3	Transient Overvoltages: Origins of switching overvoltages; Transmission line energization; Capacitor bank switching transients; Inrush current surge; back-to-back capacitor bank switching; Transient recovery voltage; Reactor, energization; High frequency transients; Consequences of Overvoltages; Solutions to transient overvoltages.	Chapter 4
Week 4	The Fourier Series: Theory; Symmetrical and orthogonal properties; Fast Fourier Transform; Harmonic and time-domain plots; Synthesizing voltage and current waveforms.	
Week 5	Harmonic Distortion Limits: THD definition; Harmonic voltage and current distortion limits; Sources of harmonics with examples; Harmonic guidelines.	Chapters 3 and 7
Week 6	<u>Laboratory</u> : Harmonic Analyser Based on LabVIEW - Measuring voltage and current waveforms and plotting the harmonic spectrum	
Week 7	<u>Mid-Term Exam</u> : Based on previous 5 week lectures (2.5 hours)	
Week 8	Measurement of Harmonic Distortion: Objectives, Point of Common Coupling; Power quality meters; Measuring technique; Measuring Standards	Chapter 6
Week 9	Harmonic Mitigation and Solutions: Harmonic distortion; Mitigating harmonics in industrial environment; Isolating harmonic loads; line/load reactors; 6-12-18 pulse converters; Fuses; Tuned filters.	

Week 10	Impacts of Harmonics on Power Network Systems: Conductors and cables, transformers; Relays; Wind and solar farms, Electric vehicle chargers; Home appliances	
Week 11	Harmonic Frequency-Scan Analysis: Admittance matrix modeling; Two-port network configuration; The equivalent T- and π -networks; Series and parallel connections in two-port networks; Impedance plot and harmonic resonance; Case studies	
Week 12	Harmonic Power Flow: 3-Ph network admittance matrix modeling; Algorithms for harmonic modeling of transmission lines, transformers, capacitors and reactors, loads and generators; Solving harmonic load flow for each frequency.	
Classes End – Wednesday, March 29, 2017		
Final Examination Period: Wednesday, April 12, 2017 at 7:30 p.m., IWC-2		
All examinations MUST BE written during the scheduled examination period.		
Note: 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.		
4. ASSESSMENT OF LEARNING		Weight
Assignments		10 %
Midterm Exam		20 %
Lab		10 %
Final Exam		60 %
TOTAL		100 %
Percentage grades will be converted to letter grades and grade points per the University calendar.		
5. LEARNING OUTCOMES		
1. Learn power quality and its impact on the power network systems		
2. Know harmonic limits, standards and guidelines for use in domestic, commercial and industrial environments		
3. Learn mitigating measures and solutions to reduce harmonic distortion		
4. Learn frequency-scan technique to identify harmonic resonance conditions		
5. Learn harmonic power flow to analyze the performance of power systems in a harmonic-generated environment.		
6. Learn power quality and its impact on the power network systems		
7. Know harmonic limits, standards and guidelines for use in domestic, commercial and industrial environments		
6. POLICIES		
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/Anti-Discrimination%20policy.pdf		
Academic Integrity		
Attention is drawn to the Statement on Academic Ethics and the Senate Resolutions on Academic Dishonesty as found in the Senate Policy Statements distributed at registration and available in the Senate Office. Any student who infringes one of these resolutions will be treated according to the published policy.		

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and 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 kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at: <http://www.mcmaster.ca/univsec/policy/AcademicIntegrity.pdf>

Requests for Relief for Missed Academic Term Work (Assignments, Mid-Terms, etc.)

The McMaster Student Absence Form is a self reporting tool for **Undergraduate Students** to report absences that last up to 5 days and provides the ability to request accommodation for any missed academic work. Please note, this tool cannot be used during any final examination period.

You may submit a maximum of 1 Academic Work Missed requests per term. It is YOUR responsibility to follow up with your Instructor immediately regarding the nature of the accommodation.

If you are absent more than 5 days or exceed 1 request per term you MUST visit your Associate Dean's Office (Faculty Office). You may be required to provide supporting documentation.

This form should be filled out immediately when you are about to return to class after your absence.

<http://www.mcmaster.ca/msaf/>

E-Learning Policy

Consistent with the Bachelor of Technology’s policy to utilize e-learning as a complement to traditional classroom instruction, students are expected to obtain appropriate passwords and accounts to access Avenue To Learn for this course. Materials will be posted by class for student download. It is expected that students will avail themselves of these materials prior to class. Avenue can be accessed via

<http://avenue.mcmaster.ca>

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.
- To check their McMaster/Avenue email and course websites on a regular basis during the term.

Turnitin (Optional)

This course will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to

www.mcmaster.ca/academicintegrity

Protection of Privacy Act (FIPPA)

The Freedom of Information and Protection of Privacy Act (FIPPA) applies to universities. Instructors should take care to protect student names, student numbers, grades and all other personal information at

all times. For example, the submission and return of assignments and posting of grades must be done in a manner that ensures confidentiality.

<http://www.mcmaster.ca/univsec/fippa/fippa.cfm>

Academic Accommodation of Students with Disabilities Policy

Student Accessibility Services (SAS) is committed to the continuous improvement of accessibility for students with disabilities. Students are encouraged to contact SAS as early as possible before each term starts to become familiar with the services offered and to confirm their accommodations.

Students must forward a copy of the SAS accommodation to the instructor of each course and to the Program Administrator of the B.Tech. Program immediately upon receipt. If a student with a disability chooses NOT to take advantage of a SAS accommodation and chooses to sit for a regular exam, a petition for relief may not be filed after the examination is complete. <http://sas.mcmaster.ca>

Student Code of Conduct

The Student Code of Conduct (SCC) exists to promote the safety and security of all the students in the McMaster community and to encourage respect for others, their property and the laws of the land. McMaster University is a community which values mutual respect for the rights, responsibilities, dignity and well-being of others. The purpose of the Student Code of Conduct is to outline accepted standards of behavior that are harmonious with the goals and the well-being of the University community, and to define the procedures to be followed when students fail to meet the accepted standards of behavior. All students have the responsibility to familiarize themselves with the University regulations and the conduct expected of them while studying at McMaster University.

<http://www.mcmaster.ca/univsec/policy/StudentCode.pdf>