

## Course Outline

### 1. COURSE INFORMATION

<b>Session Offered</b>	<b>Fall 2017</b>	
<b>Course Name</b>	<b>Chemistry</b>	
<b>Course Code</b>	<b>ENGTECH 1CH3</b>	
<b>Date(s) and Time(s) of lectures</b>	Depends on section:	
<b>Program Name</b>	Automotive & Vehicle Technology, Biotechnology, Process Automation	
<b>Calendar Description</b>	This course is designed to give students a working knowledge of the most important chemical principles as the foundation for study of more advanced topics such as chemical analysis, inorganic and applied chemistry. The course covers basic chemical laboratory procedures. Course topics include chemical formulae and equations, chemical stoichiometry, nomenclature, acids and bases, gases, chemical equilibrium, thermochemistry and thermodynamics, redox reactions.	
<b>Instructor(s)</b>	<p><b><u>Dr. Bogdanova</u></b></p> <p><b>C02</b> (Tue-1:30pm-3:30pm-T13 107) (Thur-12:30pm-2:30pm-T13 107)</p> <p><b>C04</b> (Wed-8:30am-10:30am-T13 106) (Fri- 9:30am-11:30pm-T13 107)</p> <p><b>L01/L02</b>(Tue-10:30am-1:30pm-ETB 312)</p> <p><b>L05/L06</b> (Wed 10:30am-1:30pm-ETB 312)</p> <p><b>L11/L12</b> (Fri-12:30pm-3:30pm- ETB 312)</p> <p><b><u>N. Ladanyi</u></b></p> <p><b>C01</b> (Tue-8:30am-10:30am-T13 105) (Thur-9:30am-11:30am-T13 107)</p> <p><b>C03</b> (Tue-4:30pm-6:30pm-T13 106) (Thur-4:30pm-6:30pm-T13 107)</p> <p><b>L07/L08</b> (Wed-1:30pm-4:30pm-ETB312)</p>	<p>E-mail: <a href="mailto:bogdanz@mcmaster.ca">bogdanz@mcmaster.ca</a> Office Hours &amp; Location: Friday 11:30am-12:30 pm ETB 209</p> <p>E-mail: <a href="mailto:ladanyi@mcmaster.ca">ladanyi@mcmaster.ca</a> Office Hours &amp; Location: Wednesday 11:30am-12:30pm ETB 209</p>

	<p><b><u>Dr. Ana Tomljenovic-Berube</u></b></p> <p><b>L09/L10</b> (Fri 9:30am-12:30pm-ETB 312)</p> <p><b><u>Walter Cristofoli</u></b></p> <p><b>L03/L04</b> (Tue 1:30pm-4:30pm-ETB 312)</p>	<p>E-Mail: <a href="mailto:tomljeam@mcmaster.ca">tomljeam@mcmaster.ca</a></p> <p>Office Hours &amp; Location: Monday 2:30pm-3:30pm ETB 209</p> <p>E-mail: <a href="mailto:cristofw@mcmaster.ca">cristofw@mcmaster.ca</a></p> <p>Office Hours &amp; Location: Tuesday 12:30pm-1:30 pm ETB 209</p>
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## 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	36
	L	Laboratory, workshop or fieldwork	21
	T	Tutorial	12
	DE	Distance education	
<b>Total Hours</b>			69
<b>Resources</b>	<b>ISBN</b>	<b>Textbook Title &amp; Edition</b>	<b>Author &amp; Publisher</b>
	ISBN: 1259633977	<ol style="list-style-type: none"> <li>1. Chemistry, 12<sup>th</sup> Edition</li> <li>2. Study guide (to accompany 12<sup>th</sup> Edition)</li> </ol>	Chang, R. McGraw Hill Companies: NY, 2015
	<b>Other Supplies</b>	<b>Source</b>	
	ENGTECH 1CH3 - Lab Manual	Avenue to learn	
<b>Prerequisite(s)</b>	Registration in B. Tech I		
<b>Corequisite(s)</b>			
<b>Antirequisite(s)</b>			
<b>Course Specific Policies</b>	<ol style="list-style-type: none"> <li>1. <b><u>You must pass both Theory and Lab components (50% minimum) for a passing this course.</u></b></li> <li>2. <b><u>Attendance and Participation - regular attendance and active participation in all classroom sessions are essential for success in this course.</u></b></li> <li>3. <b><u>Absences, Late Submissions, and Re-writes.</u></b>  <b>(3.1.) Quizzes.</b> All quizzes must be written in class. There are no re-writes. If you miss a quiz because of an emergency, you must contact the professor no later than the next business day and send MSAF. </li> </ol>		

**(3.2.) Tests.** All tests are to be written at the times announced, unless alternative arrangements have been made previously between the student and the professor to cover exceptional circumstances. Students with special needs must follow inform the professor through McMaster Disability Services of their requirements five days prior to the test date so that alternative arrangements can be made.

If you miss a test because of an emergency, you must contact the professor no later than the next business day and sent MSAF. Proof and details of the emergency (such as a doctor's note) must be presented to the professor before alternate arrangements can be finalized. All notes will be verified for their authenticity.

All make-up tests are to be written at a pre-arranged time in the designated area in accordance with the student policy manual.

Students who fail to appear after having made arrangements for the re-write, according to the above, will be considered "absentees" and will be assigned a grade of zero for the test.

Students who fail a test will not be permitted to rewrite the test under any circumstance.

**(3.3.) Labs.** A three-hour lab from the Departmental Manual will be performed **every other week**. Students are expected to attend all labs and to submit a lab report for all labs. If you miss a lab because of an emergency or sickness, you must contact the instructor no later than the next business day; you must submit a MSAF and make alternate arrangements to do the lab. Failure to do so will automatically result in a grade of 0 for the missed lab.

Students are expected to come and wait outside the lab at least 2 to 5 minutes before the scheduled start time. Only 5 minutes' grace period will be allowed before late penalty is deducted from the lab mark. Six minutes late will have a penalty of 6 marks and one mark every minute after to a maximum of 20 marks deducted for 20 minutes late. After 20 minutes, except for valid reasons, no one will be allowed to get in to do the experiment and a grade of zero will be given for the lab.

Reports are due two weeks after completion of the laboratory work. Reports submitted late without a suitable explanation will incur a penalty of 15% per day, including weekends and statutory holidays. Students are expected to have pre-lab exercises completed prior to attending the lab. Students failing to do so will be required to complete the pre-lab exercises before being admitted into the lab and will not be awarded extra time to complete the lab work.

**(3.4) Group Project and presentation.** There should be 3 students in a group and 15-minutes presentation per group (5 minutes per student). Late submissions will be penalized – 15% per day, including weekends and statutory holidays.

<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>Atoms, Moles, and Molecules</b></p> <p>Matter and property of matter, mixtures and pure substances, physical and chemical properties, the mass-volume-density relationship, equivalencies and unit factors, factor-label method, atomic theory, the Laws of Definite and Multiple Proportions, the Law of Conservation of Mass, atomic mass units, Avogadro’s Number, molar mass, diatomic molecules, and percentage composition by mass.</p>	<p>Module 1</p> <p>Text – Chapters 1,2,3</p>
Week 2	<p><b>Atoms, Moles, and Molecules (2)</b></p> <p>Mater and property of matter, mixtures and pure substances, physical and chemical properties, the mass-volume-density relationship, equivalencies and unit factors, factor-label method, atomic theory, the Laws of Definite and Multiple Proportions, the Law of Conservation of Mass, atomic mass units, Avogadro’s Number, molar mass, diatomic molecules, and percentage composition by mass.</p>	<p>Module 1</p> <p>Text – Chapters 1,2,3</p>
Week 3	<p><b>Reactions and Equations (1)</b></p> <p>Chemical reactions and chemical equations, balancing chemical equations, stoichiometry and stoichiometric coefficients, the mole method, stoichiometric calculations, limiting and excess reagents, and yields (theoretical, actual, and percentage).</p>	<p>Module 2</p> <p>Text – Chapter 3</p>

Week 4	<p><b>Reactions and Equations (2)</b></p> <p>Chemical reactions and chemical equations, balancing chemical equations, stoichiometry and stoichiometric coefficients, the mole method, stoichiometric calculations, limiting and excess reagents, and yields (theoretical, actual, and percentage).</p>	<p>Module 2</p> <p>Text – Chapter 3</p>
Week 5	<p><b>Nomenclature</b></p> <p>Naming ionic compounds, molecular compounds, binary acids, and oxoacids by using different systems in current use and naming hydrates.</p> <p style="text-align: center;"><b>Mid-term Test 1</b></p>	<p>Module 3</p> <p>Text – Chapters 2,4</p>
Mid-term Recess: Monday, October 9 to Sunday, October 15, 2017		
Week 7	<p><b>Aqueous Solutions (1)</b></p> <p>Solution composition, electrolytes, solubility and solubility rules, molecular, ionic and net-ionic equations, concentration (% w/v, % w/w, g/L, ppm, ppb, M), dilution and the Dilution Law, and stoichiometric calculations.</p>	<p>Module 4</p> <p>Text – Chapter 4</p>
Week 8	<p><b>Aqueous Solutions (2)</b></p> <p>Solution composition, electrolytes, solubility and solubility rules, molecular, ionic and net-ionic equations, concentration (% w/v, % w/w, g/L, ppm, ppb, M), dilution and the Dilution Law, and stoichiometric calculations</p>	<p>Module 4</p> <p>Text – Chapter 4</p>
Week 9	<p><b>Acids and Bases in Aqueous Media</b></p> <p>Arrhenius acids and bases, Brønsted acids and bases, strong and weak acids and bases, acid-base titrations and stoichiometry, standard solutions, indicators, pH/pOH calculations, and the pH scale.</p>	<p>Module 5</p> <p>Text – Chapters 4,15</p>
Week 10	<p><b>Gases</b></p> <p>Topics covered include pressure and atmospheric pressure, temperature scales, Boyle's Law, Charles's Law, Gay-Lussac's Law, Avogadro's Law, the Combined Gas Law, the Ideal Gas Law, STP, Dalton's Law of Partial Pressure, mole fractions, and related stoichiometric calculations.</p>	<p>Module 6</p> <p>Text – Chapter 5</p>
Week 11	<p><b>Equilibrium</b></p> <p>Reversible reactions, equilibrium constants, the Law of Mass Action, homogeneous and heterogeneous equilibria, the reaction quotient, Le Châtelier's Principle.</p>	<p>Module 7</p> <p>Text – Chapter 14</p>

	<b>Mid-term Test 2</b>	
Week 12	<b>Thermochemistry</b> Heat capacity, specific heat capacity, calorimetry, enthalpy, standard enthalpy, standard enthalpy of formation, Hess's Law (Methods Indirect and Direct)	Module 8 Text – Chapter 6
Week 13	<b>Thermodynamics</b> The first law of Thermodynamics, the Second Law of Thermodynamics, and Gibbs Free Energy  <b>Redox Reactions</b> Oxidation numbers, balancing redox reactions, oxidizing acids, single replacement reactions, and the activity series	Module 8 Text – Chapter 6 Module 9 Text – Chapter 18
Classes end: Wednesday, December 6, 2017 Final examination period: Friday, December 8 to Thursday, December 21, 2017 All examinations MUST be written during the scheduled examination period.		
<b>List of experiments</b>		
Week 1 (Sept.5-8) – <b>Introduction</b> L01/L03/L05/L07/L09/L11	<b>Introduction</b> Do hands-on chemistry; Connect chemical practice to theory; Organize and produce written reports	
Week 2 (Sept.11-15) – <b>Introduction</b> L02/L04/L06/L08/L10/L12	<b>Introduction</b> Do hands-on chemistry; Connect chemical practice to theory; Organize and produce written reports	
Week 3 (Sept.18-22) – <b>Lab 1</b> L01/L03/L05/L07/L09/L11	<b>Experiment 1</b> Volumetric Analysis 1 - Sodium Carbonate and Hydrochloric Acid	
Week 4 (Sept.25-29)– <b>Lab 1</b> L02/L04/L06/L08/L10/L12	<b>Experiment 1</b> Volumetric Analysis 1 - Sodium Carbonate and Hydrochloric Acid	
Week 5 (Oct.3-7)– <b>Lab 2</b> L01/L03/L05/L07/L09/L11	<b>Experiment 2</b> Synthesis of Copper(II) Sulfate Pentahydrate	
Mid-term Recess: Monday, October 9 to Sunday, October 15, 2017		
Week 6 (Oct.17-21) - <b>Lab 2</b> L02/L04/L06/L08/L10/L12	<b>Experiment 2</b> Synthesis of Copper(II) Sulfate Pentahydrate	
Week 7 (Oct. 24-28) - <b>Lab 3</b> L01/L03/L05/L07/L09/L11	<b>Experiment 3</b> Volumetric Analysis 2 - Oxalic Acid, Sodium Hydroxide and Vinegar	
Week 8 (Oct.31-Nov.4) - <b>Lab 3</b> L02/L04/L06/L08/L10/L12	<b>Experiment 3</b> Volumetric Analysis 2 - Oxalic Acid, Sodium Hydroxide and Vinegar	
Week 9 (Nov.7-11)– <b>Lab 4</b> L01/L03/L05/L07/L09/L11	<b>Experiment 4</b> Collection of Hydrogen Gas Over Water – The Reaction of Hydrochloric Acid with Magnesium and Zinc Metals	

Week 10 (Nov.14-18)– Lab 4 L02/L04/L06/L08/L10/L12	<b>Experiment 4</b> Collection of Hydrogen Gas Over Water – The Reaction of Hydrochloric Acid with Magnesium and Zinc Metals
Week 11 (Nov.21-23) – Lab 5 L01/L03/L05/L07/L09/L11	<b>Experiment 5</b> Calorimetry - The Strong Acid / Strong Base Reaction and the Reactions of Hydrochloric Acid with Magnesium Metal and with Magnesium Oxide
Week 12 (Nov.28-Dec.02)- Lab5 L02/L04/L06/L08/L10/L12	<b>Experiment 5</b> Calorimetry - The Strong Acid / Strong Base Reaction and the Reactions of Hydrochloric Acid with Magnesium Metal and with Magnesium Oxide

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.

4. ASSESSMENT OF LEARNING *including dates*	Weight
Assignments (in class)	10
Mid-term tests (2)	30 (2x15)
Project	10
Labs	20
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. To review and apply the concepts of chemical symbols, formulae, atoms and molecules, the mole (mol), and stoichiometry of chemical compounds and chemical composition.
2. To discuss the most important rules and concepts for writing chemical reactions as standard equations, to calculate reacting amounts and yields of products, and to determine theoretical and percentage yields using reactions of industrial importance
3. To name chemical compounds using different systems in current use and to demonstrate a basic vocabulary of compounds by name and formula.
4. To define appropriate terms and make calculations in the use of chemicals in solutions, including units, solution preparation and solution reaction stoichiometry.
5. To define basic terms and explain the importance of Arrhenius and Bronsted acids and bases and the pH/pOH concept, and to perform calculations involving acid-base stoichiometry and simple titrations.
6. To apply the Ideal Gas Law equation, Avogadro's Law and Dalton's Law to mass relationships and stoichiometry where the product is a gas or a mixture of gases.
7. To explain reversible reactions, equilibrium constants, and Le Chatelier's Principle and apply them to a variety of chemical reactions.
8. To define the basic terms associated with thermochemistry and thermodynamics including specific heat capacity and Hess' Law, to apply Hess' Law to calculate heat changes associated with a variety of chemical reactions, and to explain the First and Second Laws of Thermodynamics and the Gibbs Free Energy term.

9. To define oxidation numbers and assign them by using simple rules and to balance a variety of oxidation-reduction (redox) reactions.

## 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/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 required to exhibit honestly 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 kinds of academic dishonesty please refer to the Academic Integrity Policy, located at: <http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf>.

The following illustrates only three forms of academic dishonesty:

1. Plagiarism. E.g. the submission of work that is not 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.

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

The McMaster Student Absence Form is an on-line self-reporting tool for Undergraduate Students to report absences for:

- 1) Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:
  - Students may submit a maximum of one academic work missed request per term. It is the responsibility of the student to follow up with instructors immediately (within the 3 day period that is specified in the MSAF) regarding the nature of the accommodation. All work due in that time period however can be covered by one MSAF.
  - MSAF cannot be used to meet religious obligation or celebration of an important religious holiday, for that has already been completed or attempted or to apply for relief for any final examination or its equivalent.
- 2) For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has not been used previously in that term:
  - Students must visit their Associate Dean's Office (Faculty Office) and provide supporting documentation.

### 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. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail account, and program affiliation may become apparent to all other students



in the course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about this disclosure please discuss this with the course instructor. 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.
- Check the 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 submit their assignment/work electronically to Turnitin.com where it is checked against the internet, published works and Turnitin's database for similar or identical work. If Turnitin finds similar or identical work that has not been properly cited, a report is sent to the instructor showing the student's work and the original source. The instructor reviews what Turnitin has found and then determines if he/she thinks there is a problem with the work. 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

<http://www.mcmaster.ca/academicintegrity/turnitin/students/>

### **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/fippra/fippra.cfm>

### **Academic Accommodation of Students with Disabilities Policy**

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 contacted by phone 905-525-9140 ext. 28652 or e-mail [sas@mcmaster.ca](mailto:sas@mcmaster.ca). For further information consult McMaster's policy for Academic Accommodation of Students with Disabilities

<http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf>

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://judicialaffairs.mcmaster.ca/pdf/SCC.pdf> and <http://www.mcmaster.ca/policy/Students-AcademicStudies/StudentCode.pdf>