

CHMB16H3

TECHNIQUES IN ANALYTICAL CHEMISTRY

FALL 2014 COURSE SYLLABUS

Course Objective

To describe and introduce the fundamentals of Analytical Chemistry. To provide you the basic lab and classroom tools need to progress further in the field. The basics of statistics, errors, titrations, electrochemistry, optical and molecular spectroscopy as well as separations are discussed.

Course Instructors

Prof. Andre Simpson (Theoretical), e-mail: andre.simpson@utoronto.ca
Room SY324, Science Research Building.
Office hours: Mondays 12-2 pm in the Environmental NMR Centre (SY050)

Dr. Farkhondeh Fathi (Practical), e-mail: far.fathi@mail.utoronto.ca
Room SW640, Science Wing
Office hours: Tuesday 1:30 – 3:00 pm, Thursdays 1:30-3 pm

Course and Mid location/time : Mon 9-12 am in SW319

WebOption will be available!

<https://lecturecast.utsc.utoronto.ca/login.php>.

Required Text: Students are strongly encouraged to reiterate what they learn in the lectures with the relevant sections from the following textbook:

<p><i>Fundamentals of Analytical Chemistry</i>, Skoog/West/Holler/Crouch, 9th Edition. Brooks/Cole CENGAGE Learning.</p>
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Note: Lecture topics include suggested review problems from the text. Such material may be included on tests, tutorials, and exams.

Recommended: *Student Solutions Manual for Skoog/West/Holler/Crouch's Fundamentals of Analytical Chemistry, 9th Edition*

The solutions manual is useful for testing and confirming your own learning. We will not specifically refer to or use the solutions manual in this class.

The UTSC book store is currently stocking a package of both the text book and the solutions manual. This is at a discounted price and is the best value

It is strongly recommended that before you start the labs you read Chapter 2 “Tools of Analytical Chemistry” in addition to the lab manual.

PLEASE DOWNLOAD AND PRINT THE LECTURE MATERIAL BEFORE YOU COME TO EACH CLASS FROM BLACKBOARD. THERE WILL BE SPECIAL “EASY PRINT” FORMAT. BRING THE NOTES SO YOU CAN ADD TO THEM DURING CLASS

Evaluation:

Mid-term Exam-1	12%
Mid-term Exam-2	12%
Labs	40%
Final Exam	36%

Course Policies and General Information:

Course Announcements: Announcements, updates to readings, assignment topics, requirements, and evaluation, etc. will be posted to the course site. Students are responsible for checking the course website regularly. **Please, arrange your UTORONTO emails to accept the course announcements.**

Lab Attendance: Attendance at lectures and labs is expected. Attendance is taken in labs and tutorials. If you need to miss a laboratory period for any *valid* reason, you must contact Dr. Fathi either by phone (416-287-7209) or by e-mail (far.fathi@mail.utoronto.ca) *before* your next scheduled lab period. If the reason for your absence is medical, you must download a UTSC Medical Certificate and have it completed by your doctor (download at: http://www.utsc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf) The completed note must contain the following information:

- Verification that you were examined on or before the day of your missed lab
- The nature of your illness
- A statement indicating the physician's professional opinion as to whether you should receive special consideration on medical grounds

Submit your completed medical note to Dr. Fathi within one week of your absence. A make-up lab will be rescheduled provided that space and time permits. If a make-up lab is not possible, the marks from the other labs will be re-weighted to make up for the missed lab.

Given the importance of the lab component of this course, any labs missed in excess of one will receive a mark of zero, **regardless of the reason**, and no re-weighting will occur. Labs missed without adequate documentation will also receive a mark of zero.

Ancillary Fees: The Department of Physical and Environmental Sciences at UTSC provides state-of-the-art education in chemistry. Chemistry being an experimental science makes learning in a laboratory setting critical. In order to provide the latest technology to enhance the student learning experience, UTSC will be charging ancillary fees for all chemistry courses that have a laboratory component. Those fees are used to recover the cost

of materials and services used during the lab and to maintain and upgrade the equipment used by students. To view a complete list of those fees, students are encouraged to visit the following link:

<http://www.planningandbudget.utoronto.ca/Assets/Academic+Operations+Digital+Assets/Planning+26+Budget/2012-13+Category+5+Ancillary+Fees.pdf>

Office Hours: Students are welcome to ask questions or resolve course-related problems by contacting the Course Instructor either by dropping in during scheduled office hours or by making an appointment. Students are responsible for work missed as a result of absence; the Course Instructors will not re-teach material covered in the lectures and lab sessions.

Missed Mid-term Test: The exact dates of the mid-term tests are provided in the Course Topics schedule. Students who miss the term test will be assigned a mark of zero for the test, unless they can document a compelling reason for missing it. Students in that position must submit a written request to the Course Instructor with appropriate documentation. If a request is accepted for the mid-term test, the weighting of the mid-term will be included to the final exam. There will be no make-up mid-term tests.

Final Examination: The final examination will take place during the UTSC examination period in December following the end of the course. The exact date will be provided when the examination is scheduled.

AccessAbility: Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible. The UTSC AccessAbility Services staff (located in **S302**) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca. The sooner you let us know your needs the quicker, we can assist you in achieving your learning goals in this course.

Cell Phones: During lectures and labs please put your cell phones in silent mode to avoid disruption of the class. If circumstances warrant use of your cell phone and you must receive an emergency call, please inform the Course Instructor at the beginning of the session in advance and then excuse yourself from the session to respond to the call outside the lecture hall or laboratory.

Academic Calendar: Further information about academic regulations and course withdrawal deadlines can be found in the UTSC Calendar. You are encouraged to read this material.

Centre for Teaching and Learning: If you need assistance with effective writing skills, study skills, exam preparation, note taking, or time management, free workshops and advice are available from the Centre for Teaching and Learning, which can be reached at:

http://www.utsc.utoronto.ca/~ctl/Student_Support/index.html

Math & Statistics Learning Centre is now offering students help with any sort of questions they may have related to mathematics and statistics. Our course components involve advanced math skills. If the students are struggling, they are encouraged to drop in at AC312 and use the available general help hours. The schedule can be viewed at the link:

<http://ctl.utoronto.ca/mslc/>

Computer Use: Ethical use of University computers is expected at the University of Toronto Scarborough. Guidelines are set out in the UTSC Calendar. It is expected that the equipment and/or resources accessed in the UTSC Library and the computer labs are to be used for academic research, assignments, and course activities only.

Academic Integrity: Honesty and fairness are considered fundamental to the University's mission, and, as a result, all those who violate those principles are dealt with as if they were damaging the integrity of the University itself. When students are suspected of cheating or a similar academic offence, they are typically surprised at how formally and seriously the matter is dealt with - and how severe the consequences can be if it is determined that cheating did occur. The University of Toronto treats cases of cheating and plagiarism very seriously.

Examples of offences for which you will be penalized include (but are not limited to):

- Using any unauthorized aids on an exam or test (e.g., "cheat sheets")
- Representing someone else's work or words as your own - plagiarism (see web document "How not to plagiarize" available online at <http://www.utoronto.ca/writing/plagsep.html>)
- Falsifying documents or grades
- Purchasing an essay
- Submitting someone else's work as your own
- Submitting the same essay or report in more than one course (without permission)
- Looking at someone else's answers during an exam or test
- Impersonating another person at an exam or test or having someone else impersonate you
- Making up sources or facts for an essay or report.

As a student it is your responsibility to ensure the integrity of your work and to understand what constitutes an academic offence. If you have any concerns that you may be crossing the line, please, read from the

website <http://www.utoronto.ca/academicintegrity/resourcesforstudents.html>

and always consult your instructor. Your instructor can explain, for example, the nuances of plagiarism and how to use secondary sources appropriately; he or she will also tell you what kinds of aids - calculators, dictionaries, etc. - are permitted in a test or exam. Ignorance of the rules does not excuse cheating or plagiarism. Students agree that by taking this course all required papers may be subject to submission for textual similarity review to **Turnitin.com** for the detection of plagiarism. All submitted papers will be included as source documents in the **Turnitin.com** reference database solely for the purpose of detecting plagiarism of such papers. The terms that apply to the University's use of the **Turnitin.com** service are described on the **Turnitin.com** web site.

This information is taken from the brochure, "*Academic Integrity*" and website, part of a series of UT publications to help students understand the University's rules and decision making structures. For copies, visit the Office of the Registrar at UTSC. All of the policies and procedures surrounding academic offences are dealt with in one policy: "*The Code of Behaviour on Academic Matters*". The full text is located in the back of the UTSC Calendar.

Lecture and Exam -Schedule

Date	Topic	Reading/Learning Objectives/Suggested Problems**
Sept 8 th 2014	Intro – Basics/Fun Lecture	Chapter 1 and Chapter 4. You need to know how to do basic calculations involving moles, masses, concentrations, volumes. You need to know the basics of stoichiometry, and what ppm, ppb, ppt concentrations are. Make sure you can solve and understand examples*** , 4-1,4-2, 4-3,4-5,4-12, 4-13 from the text book. These ideas will be used in future calculations. <i>Note the Examples are highlighted boxes within the main body of the text through the textbook. Do not mix them up with the features, tables or end of chapter questions. The examples are specifically labelled as "Examples" in the text book.</i>
Sept 15 th 2014	Errors and Statistics	Chapter 5, Chapter 6, Chapter 7 Basics and types of errors, confidence intervals, normal distribution and Gaussian curves, error propagation, precision, accuracy, standard deviation, T-test, Q-test, basics of ANOVA. Make sure you can solve and understand examples*** , 5-1,5-2, 6-1, 6-3, 6-4, ,7-1, 7-6, 7-7, 7-11 from the text book.
Sept 22 nd 2014	Purity/Titrations	Chapter 13, Chapter 14, Chapter 17 (section 17D only) Endpoints, Indicators, volumetric calculations, weak/strong acid/base titrations, chelation, EDTA titrations. Make sure you can solve and understand examples*** , 13-1,13-2, 13-3, 13-4, 13-7 from the text book.
Sept 29 th 2014	Electrochemistry	Chapter 18, Chapter 19 (A-B), Chapter 21 (A-C) Oxidation numbers, REDOX, balancing REDOX equations, Electrochemical Cells, Cell Potential, Nernst Equation, Reference Electrodes, ion selective electrodes, Potentiometry, Redox Titrations, Redox in Biochemistry and the Environment. Make sure you can solve and understand examples*** , 18-1, 18-2, 19-2 from the text book.
Oct 6 th 2014	Mid Term 1 (20%*)	
Oct 13 th 2014	<i>Thanksgiving no class</i>	
Oct 20 th 2014	UV-VIS, FT-IR	Chapter 24, Chapter 25, Chapter 26 Electromagnetic Radiation, UV-VIS, chromophores, beers law, FT-IR, stretching/bending, detectors, sources, qualitative/quantitative analysis. . Make sure you can solve and understand examples*** 24-1, 24-3, 26-2
Oct 27 th 2014	Atomic Spectroscopy	Chapter 28, AA, AES, ICP-AES, ICP-MS, sensitivity, limits of detection, limits of quantitation, detectors, atomization, elemental response
Nov 3 rd 2014	FLD, LUM, Includes "Build your own instrument Dragon's Den" - Exam Recap	Chapter 27, fluorescence spectroscopy, sensitivity, fluorophores, stokes shift, quenching, chemiluminescence, phosphorescence, quantum yield, microscopy
Nov 10 th 2014	Mid Term 2 (20%*)	
Nov 17 th 2014	INTRO Separations, HPLC,	Chapter 31, Chapter 33 Separations, elution, retention time, resolution, plate theory, van Deemter, TLC, resolution, reverse phase, normal phase. Make sure you can solve and understand example*** 31-2
Nov 24 th 2014	HPLC, GC	Chapter 32, Chapter 33 Columns, types of phases, types of separations, injection, detectors, detection limits, laminar flow, isocratic and gradient elution, GC, volatility, split ratio, column types, oven ramps, gas phase detectors.
Dec 1 st 2014	CE – Exam Recap	Chapter 34c and 34d isoelectric flow, electrophoretic mobility, planar vs laminar flow, size/charge/shape, CZE, MEKC, CGE, CIEF, CITP
TBA	Final Exam (60%*)	Location and Time TBA

*Percent of the lecture section. The lecture sections are worth 60% and the labs 40% of the course.

**Use the text book to reiterate your understanding of topics covered in class. Topics not mentioned in the lectures will NOT be on the exams.

***You should make sure you understand and perform the calculations in these examples, similar questions may be on the exam.