# COURSE CHEM 221
## MATERIALS, SOLUTIONS AND INTERFACES

### GENERAL INFORMATION

| Course instructor | Dr. Jean-Michel Nunzi  
CHE 310, Chernoff Hall  
Phone: 36749  
E-mail: nunzijm@queensu.ca |
|-------------------|---------------------------------------------------------------|
| Lab instructor    | Dr. Igor Kozin  
CHE 124, Chernoff Hall  
Phone: 36000, ext. 74665  
E-mail: igor.kozin@chem.queensu.ca |
| Web site          | Access CHEM 221 Moodle space at: https://onq.queensu.ca/  
(active enrolment required). |
| Lectures          | Remote Lectures only  
Schedule: **Mon. 10:30-11:30,** synchronous;  
**Wed. 09:30-10:30** and **Fri. 08:30-8:30,** asynchronous |
| Office hours      | Friday 10-12am |
**Laboratory:** Laboratory Manual |
<p>| Recommended software | MS Excel |
| Laboratory Monday | 14:30 – 17:30 |
| 11-janv  | Introductory Lab (REMOTE TEAMS meeting, attendance mandatory) |
| 18-janv  | Studying (Vapour-Liquid) Phase Equilibrium (PE) |
| 25-janv  | catch-up week, no lab scheduled |
| 01-févr  | Methylene adsorption on charcoal (MB) |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>08-févr</td>
<td>catch-up week, no lab scheduled</td>
</tr>
<tr>
<td>15-févr</td>
<td>Reading Week, no labs scheduled</td>
</tr>
<tr>
<td>22-févr</td>
<td>catch-up week, no lab scheduled</td>
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<tr>
<td>01-mars</td>
<td>Electrochemistry of Non-ideal Solutions (NIS)</td>
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<tr>
<td>08-mars</td>
<td>catch-up week, no lab scheduled</td>
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<tr>
<td>15-mars</td>
<td>Cyclic Voltammetry (CV)</td>
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<tr>
<td>22-mars</td>
<td>catch-up week, no lab scheduled</td>
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<tr>
<td>29-mars</td>
<td>Final Date to submit outstanding labs</td>
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**Laboratory**

Labs will be held remotely:
- **Experiment 1:** (Vapour-Liquid) Phase Equilibrium (PE)
- **Experiment 2:** MB Adsorption (MB)
- **Experiment 3:** Electrochemistry of Non-ideal Solutions (NIS)
- **Experiment 4:** Cyclic Voltammetry (CV)

**Tutorials**

**Monday 8:30 – 10:00**

During tutorials, some textbook problems will be solved step-by-step.

**Marking**

- Laboratory reports: 25%
- Quiz (2 × 10%): 20% (Quiz 1 end January; Quiz 2 end March)
- Midterm examination: 25% (take-home exam)
- Final examination: 30% (remote exam)

Total 100%

A common equation sheet will append each quiz as well as the midterm and final examinations. You may use this equation sheet during the quizzes and the examinations. No other equation sheets are authorized for use during quizzes and examinations. Students must pass BOTH the lecture/tutorial and the laboratory components to pass the course. Students must obtain a combined mark of OVER 50% on the midterm and final exams to pass the lecture/tutorial component. If a student does not pass both the lecture/tutorial component of a course, they will fail the entire course. Students who do not attend all laboratory sessions may be assigned a grade of incomplete (IN) and be required to attend and pass the missed lab(s) the following year before the IN is cleared from their transcript.
COURSE OUTLINE

1. Overview of first law of thermodynamics
Overview of basic concepts learnt in the first-year chemistry course; Thermochemistry; State functions and exact differentials; Chapter 2 in all 3 editions. (4 lectures)

2. Overview of the second and third laws of thermodynamics
Direction of spontaneous change; Helmholtz and Gibbs energies; Combining the first and second laws; Chapter 3 in all 3 editions. (4 lectures)

3. Phase transitions of pure substances
Phase diagrams; Thermodynamic aspects of phase diagrams; Chapter 4 in all 3 editions.

4. Simple mixtures
Thermodynamic description of mixtures; Properties of solutions; Phase diagrams of binary systems; Activities; Chapter 5 in all 3 editions. (7 lectures)

5. Equilibrium electrochemistry
Half-reactions and electrodes; Varieties of cells; The cell potential; Standard electrode potentials; Application of standard potentials; Chapter 6 in all 3 editions. (3 lectures)

6. Molecular interactions
Electric properties of molecules; Interactions between molecules; Gases and liquids; Chapter 14 in the 11th edition, Chapter 16 in the 10th and Chapter 17 in the 9th. (3 lectures)

7. Solids
Crystallography; The properties of solids; Chapter 15 in the 11th, Chapter 18 in the 10th and Chapter 19 in the 9th edition. (2 lectures)

8. Molecules in motion *
Molecular motion; Molecular motion in liquids; Diffusion; Chapter 16 in the 11th, Chapter 19 in the 10th and Chapter 20 in the 9th edition.

* This subject will be covered if time allows.

Academic Integrity

Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility (see www.academicintegrity.org). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic
integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities at: http://www.queensu.ca/secretariat/policies/senateandtrustees/principlespriorities.html.

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1 at: http://www.queensu.ca/artsci/academic-calendars/2011-2012-calendar/academic-regulations/regulation-1 on the Arts and Science website (http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions, which contravene the regulation on academic integrity, carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

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