



UNIVERSITY OF CALGARY

DEPARTMENT OF CHEMISTRY COURSE OUTLINE Fall 2014

1. **Course:** CHEM 689.06, Selected Topics in Physical Chemistry- Solid State Electrochemistry

Lecture: Tu,Th, 12:30-1:45, SA 123; Dr. V. Thangadurai, ES 656D, Phone: 210 8649; Email: vthangad@ucalgary.ca;
Office Hours: By appointment

Course content will be available in D2L.

Departmental Office: SA 229, 220-5341, chem.undergrad@ucalgary.ca

2. **Prerequisites:** Chemistry 371, Chemistry 333, and/or consent of the Department.

3. **Grading:** The University policy on grading and related matters is described sections [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Assignments (3)	30%
Critical review	30%
Final exam (in class)	40%

Each piece of term work, including assignment, critical review, presentation and final examination submitted by the student will be assigned a percentage, and a weighted average term work percentage using weighting factors will be calculated as shown above (see below proposed grading scale).

A+	A	A-	B+	B	B-
94% - 100%	90% - 93.99%	85% - 89.99%	80% - 84.99%	75% - 79.99%	70% - 74.99%

C+	C	C-	D+	D	F
65% - 69.99%	60% - 64.99%	55% - 59.99%	50% - 54.99%	45% - 49.99%	< 45%

4. **Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize himself/herself with these regulations. See also [Section E.6](#) of the University Calendar

5. **Scheduled out-of-class activities:** Not applicable

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a clash with this out-of-class-time-activity, please inform your instructor as soon as possible so that alternative arrangements may be made for you.

6. **Course Materials:** Course materials will be provided in the class, and recommended text book(s) will be mentioned during the lecture.

7. **Examination Policy:** Closed book; Non-programmable calculators will be allowed. Students should also read the Calendar, [Section G](#), on Examinations.

8. **Writing across the curriculum statement:** For all components of the course, the quality of the student's writing in any written work will be a factor in the evaluation. See also [Section E.2](#) of the University Calendar.

9. OTHER IMPORTANT INFORMATION FOR STUDENTS:

- (a) **Academic Misconduct:** (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K. Student Misconduct](#) to inform yourself of definitions, processes and penalties
- (b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- (c) **Academic Accommodation Policy:** Students with documentable disabilities are referred to the following links: [Calendar entry on students with disabilities](#) and [Student Accessibility Services](#).
- (d) **Safewalk:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- (e) **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also

<http://www.ucalgary.ca/secretariat/privacy>
- (f) **Student Union Information:** VP Academic Phone: 220-3911 Email: suvpaca@ucalgary.ca.
SU Faculty Rep. Phone: 220-3913 Email: sciencerep@su.ucalgary.ca; [Student Ombudsman](#)
- (g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.
- (h) At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference - please participate in USRI Surveys.

Department Approval

Approved by Department Head

Date

August 19 2014

**UNIVERSITY OF CALGARY
DEPARTMENT OF CHEMISTRY
COURSE OUTLINE
Fall 2014**

Course: CHEM 689.06 Selected Topics in Physical Chemistry- Solid State Electrochemistry

Textbook: The course does not follow any specific book and required materials will be discussed in the class.

Topics to be covered

Solid State Defect Chemistry

- Lattice, Schottky, and Frenkel defects
- Kröger-Vink notations
- Thermodynamics of point defects
- Experimental investigations of lattice defects
- Equilibrium between A-site vacancies and B-site vacancies
- Equilibrium between electrons and holes
- Disorder equilibrium between solids and gas phases
- Examples of disorder in solids
- Defect equilibrium: Applications to ceramic proton conductors

Transport Properties

- Solid electrolytes and Mixed Conductors
- Transport Process of Charge Carriers in Solids
 - Particle flux in the concentration gradient
 - Particle flux in the electrical field
 - Particle flux in both concentration gradient and electrical field
- Chemical Diffusion
- Determination of partial ionic and electronic conductivities
 - Ion blocking and reversible electrodes
 - Electron blocking reversible electrodes
 - Experimental methods to determine the transference number
 - Transference measurements
 - EMF measurements using galvanic cells
 - AC impedance and DC polarization measurements

Applications of Solid Electrolytes and Mixed Conductors

- Determination of Gibbs free energy of formation of inorganic compounds
- Determination of silver activities in solid state materials
- Determination of oxygen partial pressures in metal and metal oxide mixtures
- Energy conversion and storage devices

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Date: August 19 2014