

## Chemistry 3364B Course Outline

### 1. Course Information

#### Course Information

Materials Chemistry, Chem 3364B, will be offered in the winter term in the academic year 2023-2024, three lectures a week, Monday, Wednesday, and Friday; 12:30-1:30 pm in room CHB (**Chemistry Building**) 9; no laboratory, 3 office hour to be announced and offered by TA Yihong Liu.

#### List of Prerequisites

[Chemistry 2214A/B](#) or [Chemistry 2384B](#).

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Counselling) to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

### 2. Instructor Information

Instructors	Email	Office	Phone	Office Hours
Dr. Zhifeng Ding				
TA-Ms. Yihong Liu				

Students must use their Western (@uwo.ca) email addresses when contacting their instructor and TA.

Office hour: Zoom meeting preferred; in-person is an option.

### 3. Course Syllabus, Schedule, Delivery Mode

Materials Chemistry, Chem 3364b provides an introduction to the structure, bonding, and functionalities of materials, and synthesis and characterization techniques as well as applications

**Learning Outcomes:** At the end of the course, the student will be able to

- Understand the structure, bonding, and their relationship to the properties of the materials and the jargons used in different fields of materials sciences
- Understand how materials are made and their functionality in a device

- Evaluate the requirements for materials to be used in a specific application and perform selection of materials with required properties
- Select the most appropriate analytical techniques for testing the properties of materials in specific applications.

## CHEMISTRY 3364B PRELIMINARY LECTURE SEQUENCE 2023-2024

- 1. Introduction--Classification of Materials:** Metals and alloys, semiconductors, polymers, molecular solids. (1 Lecture)
- 2. Structure of Materials:** Lattices; Translation vectors and unit Cells; lattice axes, planes and directions. Miller Indices, reciprocal Lattice, vacancies and dislocations, amorphous materials. (7 Lectures)
- 3. Bonding in Materials:** Covalent, Ionic, Metallic, Van-der-Waals; Hydrogen Bonding. Bonding in Molecular Solids.  $\pi$ -Conjugation and  $\pi$ -Stacking. (5 Lectures)
- 4. Metals:** Free electron behavior in metal, Fermi level, reciprocal lattice. (5 Lectures)
- 5. Semiconductors:** Electronic properties, intrinsic, p type and n-type semiconductors, p-n junctions, LED. Solar cells. (8 Lecture)
- 6. Nanomaterials:** Zero-dimensional nanomaterials, one-dimensional nanomaterials-nanorods, nanowires, two- dimensional nanomaterials—graphene etc. (4 Lecture)
- 7. Physical methods for materials chemistry: Diffraction and imaging:** XRD, SEM, TEM, EDX; **X-ray spectroscopy:** XPS, UPS, X-ray absorption spectroscopy (6 Lecture)

Classes begin: January 8, 2024  
Winter Reading Week: February 17 – 25, 2024  
Classes end: April 8, 2024  
Exam period: April 11 – 30, 2024

### Contingency plan

Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will **not** change. Any assessments affected will be conducted online as determined by the course instructor.

## 4. Course Materials

The lectures will be delivered as power point presentations. Lecture notes will be posted on the OWL site under resources prior to the scheduled time of the class, as will be the assignments, and announcements about the course.

1. The following Textbook will be downloaded using your Western student ID at <https://ocul-uwo.primo.exlibrisgroup.com/discovery/fulldisplay?docid=alma991044346009505163&context>

[https://www.ocul.uwo.ca/oculdiscoverynetwork/?L&vid=01OCUL\\_UWO:UWO\\_DEFAULT&lang=en&search\\_scope=OCULDiscoveryNetwork&adaptor=Local%20Search%20Engine&tab=OCULDiscoveryNetwork&query=any,contains,Bradley%20D.%20Fahlman%20Materials%20Chemistry&offset=0](https://www.ocul.uwo.ca/oculdiscoverynetwork/?L&vid=01OCUL_UWO:UWO_DEFAULT&lang=en&search_scope=OCULDiscoveryNetwork&adaptor=Local%20Search%20Engine&tab=OCULDiscoveryNetwork&query=any,contains,Bradley%20D.%20Fahlman%20Materials%20Chemistry&offset=0)

- Bradley D. Fahlman, Materials Chemistry, Springer; 2nd edition 2011, which will be provided also on the OWL site under resources for free.
2. Please install VESTA, software for free, which we will use very often from the first class on Monday, Jan 8.  
Please go to <https://jp-minerals.org/vesta/en/download.html>  
Please download the version for Windows or MAC OS. Unzip the file and cope the folder as you want on your computer hard drive.
  3. The following textbook may be useful but is not required:
    - Joel I. Gersten and Frederick W. Smith, The Physics and Chemistry of Materials, Wiley-Interscience; 1st edition (June 25, 2001).

Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

All course materials will be posted on OWL: <http://owl.uwo.ca>.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

**Technical Requirements:** Should the lecture delivery be switched to online, stable internet connection, computer with working microphone and/or webcam, Microsoft Office software etc. will be required.

## 5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Assignments (4)	40 %
In-class-iClicker	5%
Midterm Test	22 %
Final Exam	33 %

There will be two assignments before the midterm and two assignments after the midterm. Mid term is tentatively set for Friday, March 1, 2024, 6:30-8:30 pm (venue to be announced); mid term makeup will be on Friday, March 8, 2024, 6:30-8:30 pm (venue to be announced)

Final exam is set by the registrar.

“Clickers” participation will be counted 5% as above and project presentation will then be 25%. Your overall course grade, out of 100, will automatically be the higher of the two grades calculated by the two methods shown above.

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“Clickers”	Marked on participation only. The score you receive will be based on the percentage of questions answered: 80% or more = 5; 70–79% = 4; 60–69% = 3; 50–59% = 2; 40–49% = 1 Less than 40% = 0 There is NO makeup for iClicker questions
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**Conditions required to pass the course:** The assignments and midterm exam are essential components of the course. You must submit at least 2 of the 4 assignments, and write the midterm test and final exam. Students must pass the final examination (50%) to pass the course. Students who fail to meet any of these requirements without academic accommodation for the missed work will receive a course grade of not greater than 40%, even if the calculated grade is higher. A student who is unable to submit the required minimum number of assignments for medical or compassionate reasons, and who wishes to complete the missed work, will need to apply for Incomplete Standing (a grade of INC) by submitting a written request to the Dean of the Faculty of Registration. If Incomplete Standing is granted, the student will be able to complete the missed items the next time the course is offered.

**Late assignments:** All assignments must be submitted by the due date. Late submissions will be accepted for 24 hours after the due date without penalty, but will be rejected afterwards. Students who miss the automatically extended deadline and ask the instructor for accommodation will be excused. Students with applicable accommodations recommended by Accessible Education can request a longer one-time deadline extension. To preserve the integrity of evaluation, this extension cannot exceed 7 days after the regular due date because graded assignments will normally be returned by that time. Students with disability accommodations who ask for a longer extension will be excused instead, subject to the *Conditions required to pass the course*.

**Missed midterm:** A student who is unable to write the midterm must apply for permission to write a makeup that will be one week after the midterm. If a student can not make it for the midterm makeup, the weight (22%) of a missed midterm will be transferred to the final exam.

**Absences from Final Examinations:** If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (SPC Exam, the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under [Special Examinations](#)).

**Note:** missed work can *only* be excused through one of the mechanisms above. Being asked not to attend an in-person course requirement due to potential sickness symptoms is **not** sufficient on its own.

## 6. Accommodation and Accessibility

### Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays:

<https://www.edi.uwo.ca>.

### Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic\\_Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf).

## 7. Academic Policies

The website for Registrarial Services is <https://www.registrar.uwo.ca/>.

In accordance with policy,

[https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf),

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

**Use of electronic devices.** Only basic scientific calculators are permitted on tests and exams. All other electronic devices (cell phones, laptops, tablets, cameras, etc.) are prohibited. Students found in possession of prohibited devices will receive a mark of ZERO for the entire test or exam.

**Scholastic offences** are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

## 8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

[https://www.uwo.ca/health/student\\_support/survivor\\_support/get-help.html](https://www.uwo.ca/health/student_support/survivor_support/get-help.html).

To connect with a case manager or set up an appointment, please contact [support@uwo.ca](mailto:support@uwo.ca).

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

[http://academicsupport.uwo.ca/accessible\\_education/index.html](http://academicsupport.uwo.ca/accessible_education/index.html)

if you have any questions regarding accommodations.