

**Faculty of Science Course Syllabus Fall 2020** (revised June 2020)

**Department of Chemistry**

Chemistry 3305 / Physics 3303

Materials Science

Fall 2020

**Instructor(s):**

Lectures: Dr. Mark Obrovac    email: Mark.Obrovac@dal.ca

Lab: Dr. Gianna Aleman-Milan    email: Gianna.Aleman@dal.ca

**Lectures:**        Asynchronous

**Tutorials:**       Synchronous office hours for answering questions, homework help, etc.:  
MWF 10:35 am -11:25 am\*

**Laboratories:** All laboratory contents will be available asynchronously through the laboratory website in Brightspace. The content will be presented in 5 separate Modules that were developed using *Articulate Storyline 360*, an e-learning-authoring program for instructional designers. Each student will complete one introductory module and 4 experiment-based modules over the course of the term, for a total of 5 modules.

Schedule: The laboratory will start on September 8. In general, laboratory modules will be released bi-weekly on Tuesdays and will be due the following second Monday by midnight (11:59 pm, AT). For more details, please, refer to the full laboratory schedule posted in the Brightspace laboratory webpage.

Live/Synchronous Help Sessions will be held weekly using Microsoft Teams at the following times:

Tuesday: 2:00 - 4:00 pm

Sessions involving the discussion of a general topic or concept will be recorded and posted in Brightspace for access at a later time by those in different time zones.

Asynchronous Help Sessions will be held weekly in the Brightspace Discussion Board. Students will be able to post questions related to the lab content in the Brightspace Discussion Board. Questions will be answered by a Teaching Assistant or the Lab Instructor.

- Questions posted before 4:00 pm Monday to Thursday will be answered within 24 hours.
- Questions posted Friday to Sunday will be answered the following Monday or business day (if Monday is a holiday) before 4:00 pm.

Some lab modules may involve mandatory synchronous laboratory activities that will be scheduled during regular lab hours (i.e., as per Dal timetable). Details will be provided in each individual module.

**\*Note:** All times for this course are in the Canadian Atlantic Time Zone:

- March 1, 2020 - October 31, 2020: ADT = UTC-3h
- November 1, 2020 - March 7, 2021: AST = UTC-4h

## Course Description

This course emphasizes understanding the principles behind materials' physical properties, such as thermal and mechanical stability, and electrical and optical properties. Materials discussed include liquid crystals, perfect crystals, defective solids, polymers and glasses. Applications, such as the use of materials in displays, gas sensors, and lasers, are discussed.

**Note:** *The only difference between Chemistry 3305 and Physics 3303 is that Chemistry 3305 has a lab (20 hours per term) and Physics 3303 has a term paper.*

## Course Prerequisites

### CHEM 3305

CHEM 1012.03, and (CHEM 2301.03 and CHEM 2304.03) or PHYC 3200.03 (can be a corequisite) or (ERTH 2001.03 and ERTH 2002.03)

EXCLUSIONS: PHYC 3303.03, CHEM 3303.03

### PHYC 3303

CHEM 1012.03, and PHYC 3200.03 (can be co-requisite) or (CHEM 2301.03 and CHEM 2304.03) or (ERTH 2001.03 and ERTH 2002.03)

EXCLUSIONS: CHEM 3305.03

## Learning Objectives

The objective of this course is to provide students with a solid introduction to materials science. Students will gain knowledge in materials at their bulk, and, where applicable, particle, subparticle and atomic level and will learn how each relates to overall physical properties: including optical, thermal, electronic, magnetic, and mechanical properties. Using this knowledge, students will learn how materials scientists, design, make, analyse, and describe new materials for various applications.

## Course Materials

- Required textbooks
  - *Solid State Chemistry and its Applications, 2nd Ed./Student Edition* by Anthony R. West.  
Online resources and answers to all problems at:  
<http://bcs.wiley.com/he-bcs/Books?action=index&itemId=1119942942&bcsId=8612>
  - *Physical Properties of Materials* by Mary Anne White.  
Online resources and answers to all problems at:  
<http://www.physicalpropertiesofmaterials.com>
- Lecture and laboratory asynchronous content (lecture slides, laboratory modules, homework and other materials) will be made available via the lecture and laboratory Brightspace pages
- Lecture and laboratory synchronous content (lecture office hours, laboratory activities and laboratory help sessions) will be delivered via Microsoft Teams
- Computer and Internet Connection: regular access to a reliable computer that operates at a good speed and is able to handle a variety of different programs is required. High speed broadband access is highly recommended for an optimal learning experience. While tablets, smartphones or other mobile devices may allow for some completion of coursework (e.g., readings, multimedia, email, discussion board, etc.), they are not guaranteed to work in all areas. Please, ensure you have a PC or Mac based computer available to complete your lecture and lab assignments.

- Software: the software that you will need in this lab is covered by Microsoft Office 365 (Word, Excel, PowerPoint, Outlook and OneNote, etc.), available as a free download through Dalhousie. Current Dal students can download Microsoft Office 365 on up to five desktop or laptop computers. Visit the Information Technology Services (ITS) website to learn how to download Dal software.
- *Minimum technical requirements: Windows 8 or 10 (PC) or OS X (Mac).*
- *Web browser: Firefox, Chrome, Internet Explorer 11 (PC), Safari (Mac). Note that in some instances, you may need to upgrade your Flash or Java versions.*

## Course Assessment

**Note:** All times for this course are in the Canadian Atlantic Time Zone:

March 1, 2020 - October 31, 2020: ADT = UTC-3h

November 1, 2020 - March 7, 2021: AST = UTC-4h

### CHEM 3305

<i>Component</i>	<i>Weight (% of final grade)</i>	<i>Date</i>
Midterm Examination*	25%	10:35 am - 11:25 am, Friday, Oct. 23
Final Examination	40%	duration: 3 hours (to be scheduled by the Registrar)
Homework Assignments	15%	assigned regularly
Lab	20%	More details can be found in the Introductory Module: Chem3305 Remote Laboratory Syllabus, available now in the Brightspace laboratory website.

### PHYC 3303

<i>Component</i>	<i>Weight (% of final grade)</i>	<i>Date</i>
Term Paper Topic Submission	1%	10:35 am, Monday, Oct. 5
Midterm Examination*	25%	10:35 am - 11:25 am, Friday, Oct. 23
Final Examination	40%	duration: 3 hours (scheduled by the Registrar)
Homework Assignments	15%	assigned regularly
Term Paper	19%	10:35 am, Tuesday, Dec. 3

\*Midterm examination to be held during synchronous session instead of tutorial.

## Laboratory Component Assessment

Each module will be graded according to the following scheme,

Component	Intro Module	Module 1	Module 2	Module 3	Module 4
	%				
Navigation of Online Content	1	1.5	1.5	1.5	1.5
Post-lab Work	1	3	3	3	3
Experiment Total	2	4.5	4.5	4.5	4.5
Laboratory Total to CHEM3305 grade	20				

*Please, refer to the laboratory schedule in the Brightspace laboratory web page for release and due dates of modules.*

### Other course requirements

Chemistry 3305: **To pass the course, students must pass the lab.** To pass the lab, students must navigate the content of ALL five laboratory modules, submit the post-lab work (e.g., lab report) for Modules 1, 2, 3, and 4, and obtain a final laboratory mark  $\geq 50\%$ , based on the Modules 1 - 4 post-lab work submitted.

Physics 3303: You must pass the term paper ( $>50\%$ ) to pass the course.

For both Chemistry 3305 and Physics 3303: A minimum grade of 50% on the written test/final exam component is required in order to pass the course. This policy will apply to both Chemistry 3305 and Physics 3303, so you must have a passing grade ( $>50\%$ ) on the term test / final exam (i.e., weighting the term test 25 marks and the final exam 40 marks) to pass the course.

### Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D	(50-54)
A (85-89)	B (73-76)	C (60-64)	F	(<50)
A- (80-84)	B- (70-72)	C- (55-59)		

### Course Policies

All assignments must be handed in on time. Late work will not be accepted and will receive zero marks. There are no supplemental or make-up assignments, test, midterm examinations or quizzes in this class. If you are too ill to write a quiz or examination or complete an assignment in this class, please provide a Student Declaration of Absence form, as per the regulations in the University Calendar. A student who is well enough to write a test will not be allowed a re-write. However, if you are ill or experiencing an extreme personal emergency at the time of a test or an assignment, call me (lab phone: 902 494 4060 or call the main office 902 494 3305 and leave a message) or email me to inform me of the situation. In the case of an excused quiz or assignment, the others will be weighted more heavily. For an excused midterm examination, the marks for the relevant sections of the final exam will be used in place of the missed test mark.

Independent work is expected on all tests, examinations, homework assignments, term papers, etc.; and all work must be shown to receive full marks.

It is each student's responsibility to read her/his Dalhousie email and the Brightspace website.

Students who cannot write the scheduled final examination must inform the instructor prior to the start of the examination. For those students, an alternate final examination will be offered on another date.

## **Course Content**

### Lecture

Part I: Introduction to Materials Science

- atomic structure of materials
- x-ray diffraction
- defects in solids
- bonding in solids
- phase behaviour

Part II: Physical Properties of Materials (topics included as time permits)

- colour and other optical properties of materials
- thermal, electrical, magnetic, and mechanical properties of materials
- physical adsorption of gases
- ion diffusion and intercalation in solids
- materials synthesis and materials characterization methods

### Laboratory

*The Chem 3305 laboratory program consists of a total of five modules:*

- Introductory Module – Chem 3305 Remote Laboratory Syllabus
- Module 1: Preparation and Characterization of Bismuth Crystals
- Module 2: Liquid-Crystal Display: Fabrication and Measurement
- Module 3: Mechanical Properties of Materials
- Module 4: Measurement of the Index of Refraction of Solids

*Please, refer to the laboratory schedule in the laboratory Brightspace web page for release and due dates of modules.*

**Faculty of Science Course Syllabus (Section B) (revised June-2020)****Fall 2020***Chemistry 3305 / Physics 3303; Materials Science***University Policies and Statements**

**This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate**

**Missed or Late Academic Requirements due to Student Absence**

As per Senate decision instructors may not require medical notes of students who must miss an academic requirement, **including the final exam**, for courses offered during fall or winter 2020-21 (until April 30, 2021). Information on regular policy, including the use of the Student Declaration of Absence can be found here:

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html](https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html).

**Academic Integrity**

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

**Information:** [https://www.dal.ca/dept/university\\_secretariat/academic-integrity.html](https://www.dal.ca/dept/university_secretariat/academic-integrity.html)

**Accessibility**

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

**Information:** [https://www.dal.ca/campus\\_life/academic-support/accessibility.html](https://www.dal.ca/campus_life/academic-support/accessibility.html)

**Student Code of Conduct**

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

**Code:** [https://www.dal.ca/dept/university\\_secretariat/policies/student-life/code-of-student-conduct.html](https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html)

**Diversity and Inclusion – Culture of Respect**

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

**Statement:** <http://www.dal.ca/cultureofrespect.html>

**Recognition of Mi'kmaq Territory**

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) ([elders@dal.ca](mailto:elders@dal.ca)).

**Information:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Important Dates** in the Academic Year (including add/drop dates)

[https://www.dal.ca/academics/important\\_dates.html](https://www.dal.ca/academics/important_dates.html)

**University Grading Practices**

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-policy.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)

**Student Resources and Support****Advising**

**General Advising** [https://www.dal.ca/campus\\_life/academic-support/advising.html](https://www.dal.ca/campus_life/academic-support/advising.html)

**Science Program Advisors:** <https://www.dal.ca/faculty/science/current-students/academic-advising.html>

**Indigenous Student Centre:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Black Students Advising Centre:** [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)

**International Centre:** [https://www.dal.ca/campus\\_life/international-centre/current-students.html](https://www.dal.ca/campus_life/international-centre/current-students.html)

**Academic supports**

**Library:** <https://libraries.dal.ca/>

**Writing Centre:** [https://www.dal.ca/campus\\_life/academic-support/writing-and-study-skills.html](https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)

**Studying for Success:** [https://www.dal.ca/campus\\_life/academic-support/study-skills-and-tutoring.html](https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)

**Copyright Office:** <https://libraries.dal.ca/services/copyright-office.html>

**Fair Dealing Guidelines** <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

**Other supports and services**

**Student Health & Wellness Centre:** [https://www.dal.ca/campus\\_life/health-and-wellness/services-support/student-health-and-wellness.html](https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html)

**Student Advocacy:** <https://dsu.ca/dsas>

**Ombudsperson:** [https://www.dal.ca/campus\\_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html](https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html)

**Safety**

**Biosafety:** <https://www.dal.ca/dept/safety/programs-services/biosafety.html>

**Chemical Safety:** <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

**Radiation Safety:** <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

**Scent-Free Program:** <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>