Integrated Science 3001G – *Materials and Biomaterials*

Course Information: Winter 2023

Important Note:

When we implement a novel course component or refine an existing one, then the original set of rules may have to be altered. To remedy this while maintaining a high quality of course delivery, such belated syllabus rule revisions or supplements are dealt with in this course in the following way: affected rules and regulations will appear in the Course Outline for the current year in pink, the same colour in which this sentence is written. We will make every effort to avoid a negative impact on any student's learning experience caused by rule changes after the first day of class. We will disclose the added text to the Dean if a challenge is based on a provision added in pink. Based on past experience, we are confident that we will meet everyone's expectations of fairness in all such cases, and, most important of all, keep evaluation issues below the radar so that the course remains an inspiring learning experience.

In addition, syllabus updates may be issued as Announcements on this site. Please check the announcements regularly as such updates become part of the official course syllabus.

1. General Information

Welcome to Integrated Science IS3001G.

Calendar Description: An examination of the properties and applications of materials that are important to modern society. This includes both natural materials and synthetics including alloys, polymer/nanoparticle composites and optical and electronic materials. Team-based projects will investigate a problem related to the development, manufacture or analysis of a new material or biomaterial.

Prerequisites: Enrolment in Year 3 of the Western Integrated Science Program.

Antirequisites: Chemistry 3364A/B.

2 lecture hours, 2 tutorial hours, 0.5 course

Note: Unless you have either the requisites for this course or written special permission from your dean 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.

Lectures (Section 001):	Tuesdays	5:30 pm – 7:30 pm	PAB 36
Tutorials (Section 002):	Thursdays	6:30 pm – 8:30 pm	PAB 36
Help Centre:	Tuesdays	3:30 pm – 4:30 pm	PAB 116

Note: Lectures (Section 001) will be given by Prof. Singh, for tutorials stay tuned for details.

2. Contact Information:

Instructor: Prof. Mahi Singh

email: msingh@uwo.ca

office: PAB 116

office hours: t b a

3. Course Materials

Required textbook

Materials Science and Engineering (Tenth Edition)
by W. Callister and David Rethwisch
Publisher: Wiley

DO NOT PURCHASE THE eBOOK AND/OR WILEY PLUS DIRECTLY FROM THE PUBLISHER (but only through the UWO Bookstore) as no other provider but the UWO Bookstore provides access to the specific platform that has been uploaded with further material specifically developed for this course.

The URL to the course materials on the Book Store's website is as follows

https://bookstore.uwo.ca/textbook search?campus=UWO&term=W2022B&courses%5B0%5D=001_UW/INS3001G

If this link does not work, please see the UWO bookstore for assistance.

I will post lecture notes on a weekly basis. These are based on

Modern Topics in Materials Science
by Mahi R. Singh
Publisher: John Willey and Sons, Toronto (2014)

You need not to buy this book.

4. Access to OWL

You need to have access to a desktop computer or laptop with internet connection. If you do not own a computer, you can use the facilities in the GenLabs. Contact ITS at Ext. 83800 (or at (519) 661–3800 off campus) for their location and hours of operation, or for any problems when connecting to OWL at: **https://owl.uwo.ca/portal.** After entering your user id and password, you click on the course tab for your Integrated Science course: **INTEGRSCI 3001G 001 FW22.**

Scientific calculator: i s r e q u i r e d f o r quizzes and exams. Only non-programmable, non-networked calculators are permissible.

5. Course Content

The course content is *tentatively* outlined in the following table, in particular not all the topics may be covered in class.

	Topic
1	Bonding in materials
2	Crystal structures of materials
3	Polymers and biomaterials
4	Electronic properties of materials
5	Metals, semiconductors, and superconductors
6	Nanomaterials: Quantum Wells, Quantum Dots, and nanotechnology
7	Nanomaterials: Graphene
8	Semiconductor devices
9	Optical Properties of Materials
10	Photonic crystals
11	Metamaterials
12	Nano-plasmonics, nanotechnology and nanomedicine
13	Mechanical and Thermal Properties of Materials

Learning outcomes

Below you will find learning outcomes, roughly chronologically corresponding to the Units in the course. In addition, you find Learning Objectives at the beginning of each chapter in the required textbook. Note that some of these learning outcomes encompass quite a bit of course material that is implicitly assumed to be understood! In addition, you will for material covered be able to:

- Explain the types of bonding in materials and their relative strength.
- Identify crystal structures.
- Label crystal coordinates, directions, and planes.
- Understand the basic properties of polymers.
- Abel to explain a simple microscopic model of conductivity.
- Understand difference between metals, semiconductors, and superconductors.
- Understand difference between intrinsic and extrinsic semiconductors
- Understand the concept of dielectric constant and propagation of electromagnetic wases in materials.
- Explain physics behind semiconductor devices (e.g., diodes).
- Able to explain the concept of phonons and Einstein model of specific heat.
- Able to understand light propagation in photonic crystals.
- Able to explain the difference between light propagation in normal materials and metamaterials.
- Able to explain the band structure of graphene.
- Understand the concept plasmonic materials and their applications.

6. Evaluation

Your final grade in this course will be derived according to:

Quizzes	20%
Midterm Test (March 7 in PAB 26)	20%
Final Exam (TBD)	20%
Group Project (Deadline April 4)	30%
Group Presentation (April 4)	10%

- **Quizzes** will be held in class approximately every other week beginning in week 3. There will be no "make-up" quizzes – if you are granted academic considerations for a quiz for reasons approved by the Science Academic Counsellors, your quiz grade will be based on the remaining quizzes.
- **Midterm**: The midterm will be held in class on March 7th. You may bring a non-programmable, non-graphing, non-wi-fi-enabled calculator for the exam. No other aids, including additional sheets, computers, tablets, cellular phones, PDAs, advanced calculators, or other electronic devices are permitted, unless specified otherwise on this OWL site.
- **Final Exam:** The **final exam** will be held on a date specified by the Office of the Registrar. As with the midterm, you may bring a non-programmable calculator; again, no other material unless specified on this OWL site.
- **Group Project:** Details for the group project will be discussed in class and posted by week 4. Students will be assigned to groups of 5–6 students and will research outside class time a topic in materials science with an interdisciplinary nature. A joint paper of at least 2500 words will be due by April 4th.
- **Group Presentations:** The group presentations will be held during the last week of classes in class. Each group will jointly present their projects in a conference-style talk of no more than 12 minutes, with 3 minutes for questions from the audience.

Note that to earn a passing grade in this course, a passing grade is needed on both the "examination" (quizzes, test, and final) and "project" (group project, and presentations) portion of the course.

7. Academic Consideration for Missed Work

Students who are seeking academic consideration for missed work during the semester may submit a self-reported absence form online provided that the absence is 48 hours or less and the other conditions specified in the Senate policy at

www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf

are met.

Students whose absences are expected to last longer than 48 hours, or where the other conditions detailed in the policy are not met (e.g., the student has already used 2 self-reported absences), may receive academic consideration by submitting a Student Medical Certificate (for illness) or other appropriate documentation (for compassionate grounds) to the Science Academic Counselling Office (via the Help Portal at https://www.uwo.ca/sci/counselling/). The Student Medical Certificate is available online at

www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

All students pursuing academic consideration, regardless of type, must contact their instructors no less than 24 hours following the end of the period of absence to clarify how they will be expected to fulfill the academic responsibilities missed during their absence. **Students are reminded that they should carefully consider the implications of postponing tests and exams or delaying submission of work and are encouraged to make appropriate decisions based on their specific circumstances.**

Students who have conditions for which academic accommodation is appropriate, such as disabilities or ongoing or chronic health conditions, should work with Accessible Education Services to determine appropriate forms of accommodation.

Make-up and late policies specific to this course are as follows:

a) *Quizzes*: Students who have received academic considerations to miss a quiz, via either a self-reported absence or for reasons approved by their academic counsellors, will receive a quiz grade based on their remaining quizzes. There will be no make-ups for missed quizzes.

b) *Midterm Test:* There will be no make-up for the midterm, if the midterm is missed with documentation submitted to the Dean's counselling group, then the weight of this course component will be added to the Final Exam.

c) *Projects:* Students are encouraged to work on their group projects well in advance of the due dates. Late penalties of 10%/day will be applied.

d) *Final Exam:* 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 (the name given by the University to a makeup Final Exam).

Accommodations are made for religious holidays, however have to be approved by your counsellor. University policy on religious accommodations and a link to a calendar of dates is available at:

www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf.

8. Accessibility and Support

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Accessible Education at 661-2111 x 82147 or aew@uwo.ca for any specific question regarding an accommodation.

Information on Western's policy on accommodation can be found at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf.

Students who are in emotional/mental distress should refer to Mental Health@Western

https://www.uwo.ca/health/

for a complete list of options about how to obtain help.

For registration services (e.g., course enrolment, student finances, student records), please see

http://www.registrar.uwo.ca.

The University Students' Council (UCC) also offers a wide range of services. Please see

https://westernusc.ca/your-services/.

for details.

9. Academic Policies

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

Cheating includes having available in a test or exam any electronic devices other than those explicitly permitted. You may not have a cell phone accessible during quizzes or exams, even to use as a calculator or watch.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).