# Integrated Science 1001X (2020–21)
# Exploring the Landscape of Science

## *Course Description & Prerequisite Requirements*

Calendar description: *Foundational topics of biology, chemistry, computer science, earth science and physics learned through an integrated problem-based approach. Small-group interactions and integrated laboratory experiments will foster teamwork and develop problem-solving and critical-thinking skills. The importance of mathematical approaches and the use of statistics will be emphasized throughout the course.*

Extra information: 13 lecture hours and 10 laboratory/tutorial hours per week, 2.0 course.

Prerequisites: Enrollment in Year 1 of the Western Integrated Science program and a minimum of 60% in each of Calculus 1000A/B or 1500A/B, Chemistry 1301A/B, and Physics 1301A/B or 1501A/B.

Antirequisites: Chemistry 1302A/B; Physics 1029A/B, 1302A/B and 1502A/B; Biology 1002A/B; Mathematics 1225A/B; and Calculus 1301A/B and 1501A/B.

Unless you have either the prerequisites 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.

## *COVID-19*

As of January 5, 2021, the anticipated trajectory of COVID-19 in our region and in Ontario is unknown. It is possible that the provincial lockdown will extend beyond January 23. Even if the lockdown were lifted, restrictions are likely to remain. Accordingly, many aspects of the course, such as delivery method, deadlines and dates, and activities may change. The entire 1001X team is committed to your success in these difficult times and will always keep you informed of any new developments.

## *Course Website*

News and course updates will be posted on OWL (http://owl.uwo.ca), Western's learning-management system. This is the primary method by which information will be disseminated to all students in the class, so you are responsible for checking OWL on a frequent basis.

# *Academic Policies and Legalities*

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at this website: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Tests and examinations in this course may be conducted using Zoom or a remote proctoring service such as Proctortrack. Please note the following:

- When Zoom is used for test or exam invigilation, you will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session using Zoom will not be recorded. Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor in advance of the test or examination.
- Proctortrack will require you to provide personal information (including some biometric data). The session will be recorded. By taking this course, you are consenting to the use of this software. More information about remote proctoring is available in the Online Proctoring Guidelines at the following link: https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf
- Completion of this course will require you to have a reliable internet connection and a device that meets the system and technical requirements for both Zoom and Proctortrack. Information about the system and technical requirements are available at: https://www.proctortrack.com/tech-requirements and https://support.zoom.us/hc/en-us

# *Learning Outcomes*

Broadly speaking, a student receiving credit for the course will be expected to reliably demonstrate competence in their ability to:

- Think critically about, explain, integrate, and apply scientific principles, laws, and theories.
- Solve a variety of novel problems, whether qualitative, quantitative, or mathematical.
- Draw scientific conclusions from experimental results or data.
- Examine, integrate, and assess any provided or collected scientific data.
- Communicate scientific thoughts and ideas in writing.
- Obtain, evaluate, and integrate information from various sources, and determine its relevance.
- Analyze and critically assess problems, and take a systematic approach to solving them.
- Use a variety of laboratory equipment and instrumentation.
- Safely execute a variety of experimental procedures and explain the theory behind them.
- Form productive and collaborative working relationships with other individuals.
- Prioritize a set of tasks and manage the use of their time.

# *Class and Personnel Information*

Classes (lectures), when held in-person, will take place at the times and locations specified below. When it is not possible or feasible to have them in-person, they will be offered synchronously via Zoom or another platform at the same times.

- Mon and Fri, 9:30–11:30, in NSC 1 Tue and Thu, 9:30–12:30, in NSC 145
- Wed, 9:30–12:30, in NSC 1

Contact information for the course personnel is provided below.

| **Instructor** | **Office** | **Email** |
|---|---|---|
| Christina Booker | CHB 21 | cbooker2@uwo.ca |
| Gurpaul Kochhar | MSA 1201 | gkocchar@uwo.ca |
| Felix Lee (course coordinator) | MSA 1202 | flee32@uwo.ca |
| Denis Maxwell | NCB 240 | dmaxwell@uwo.ca |
| Bryan Sarlo | MC 361 | bsarlo@uwo.ca |
| Rasul Shafikov | MC 112 | shafikov@uwo.ca |
| Cam Tsujita | BGS 1064 | ctsujita@uwo.ca |
| Renee Webber (lab supervisor) | CHB 380A | rwebbe@uwo.ca |

Remember, we're here to help you! If you find yourself not understanding the lectures, assigned readings, or problems, please come to our scheduled office hours, which will be posted on OWL, or set up an appointment by sending an email **from your Western email account**. Questions related to course material can also be posted on the OWL discussion board.

# *Laboratory and Tutorial Sections*

Much of how the labs and tutorial/teamwork sessions will run depends on how COVID-19 and the Ontario lockdown unfolds. Assuming the lockdown ends in the near future, the course will typically have one in-person lab, one or two online labs, and one or two in-person tutorial/teamwork sessions per week. Alternate online labs will be available for students who cannot, or would rather not, attend an in-person lab. Obviously, during the lockdown, all lab and tutorial/teamwork activities will be online.

The class has been divided into four groups (A, B, C, D) in order to accommodate physical-distancing requirements and to respect room-capacity limits. Please check your email for your group. For the most part, the general in-person lab and tutorial/teamwork schedule for the four groups will be as follows:

| Component | Mon | Tue | Wed | Thu |
|---|---|---|---|---|
| In-person lab, 1:30–4:30 (online alternative also available) | A | B | C | D |
| Tutorial/teamwork, 1:30–3:30 | B and D | A and C | B and D | A and C |
| None | C | D | A | B |

A schedule that explains what you will be doing on a given week will be available on OWL.

# *Course Materials*

All of the materials below are required. Some of these materials are the same as the ones you had used in the first term. (Laboratory manuals do not need to be purchased. Experiments, tutorials, exercises, etc. will be available on OWL for download.)

1. *Calculus, Volume 2*, by Strang, Herman, et al. The open-source textbook is found at: https://openstax.org/details/books/calculus-volume-2
2. *Chemistry 1302B Course Workbook*, 2020–21 edition. The book is digital-only and is found at: https://www.vitalsource.com/en-ca/products/chemistry-1302a-b-discovering-chemical-energetics-department-of-chemistry-v9781533925503
3. *Sears & Zemansky's College Physics*, 11th edition, by H.D. Young and P.W. Adams
4. *Programming in Python 3 with zyLabs*, an online book
    - Sign in or create an account at learn.zybooks.com
        - Be sure that your account uses your official name and your uwo.ca email
    - Enter zyBook code UWOINTEGSCI1001XSarloSpring2021
    - Choose your desired package (school term only, or school term + 1 year), enter your payment information, and click Subscribe.
5. Proper laboratory attire, including lab coat, safety glasses, pants, socks, and shoes without any openings or holes.
6. Non-programmable scientific calculator

# *Overview of Course Topics – by Question*

Integrated Science 1001X takes a different approach to science education by addressing four broad questions, each one of which addresses the learning outcomes found in the traditional, first-year science courses. A non-exhaustive list of the topics in each question is provided below. The approximate start dates for each question are subject to revision.

1. How did Earth evolve? (starts January 11)
    - Evolution of the universe
    - Formation and evolution of planets and atmospheres
    - Rocks, minerals, plate tectonics, and geophysics
    - Evolution of the periodic table
    - Climate change
    - Evolution of life

2. What is energy, and how do we harness it? (starts February 8)
    - Mechanical energy, including wind and water
    - Fossil fuels and combustion
    - Solar energy
    - Electrical energy and magnetism
    - Nuclear energy
    - Photosynthesis and biological energy

3. What is life? (starts March 18)
    - Structure, function, and regulation of proteins and nucleic acids
    - Thermodynamics of life and equilibrium processes
    - Cellular metabolism
    - Adaptation to extreme environments
    - Bioinformatics

4. How does my smartphone work? (starts January 11 and lasts the duration of the course)
    - Computing and applications
    - Fundamentals of programming and programming structures
    - Methods of input and output
    - Debugging code
    - Visualization
    - Machine learning
    - Minerals, materials, and semiconductors
    - Batteries, energy management, and overheating

Because mathematics (especially calculus) is an essential tool in science and in these topics, a certain number of classes has been dedicated to mathematics.

# *Overview of Course Topics – by Subject*

The Faculty of Science considers Integrated Science 1001X to be an acceptable substitute for Biology 1002A/B, Calculus 1301A/B, Chemistry 1302A/B, and Physics 1302A/B. Listed below is a non-exhaustive summary of the topics in the four above subject areas that are covered in 1001X. A list of the topics in the computer science component of 1001X is also provided.

- Biology
    - Molecular genetics and evolution
    - Proteins: structure, denaturation, enzymes, evolution
    - Membranes: structure, function
    - Photosynthesis, cellular respiration, and bioenergetics
- Calculus
    - Integration techniques
    - Improper integrals
    - Differential equations
    - Modelling and differentia equations
    - Series with constant coefficients
    - Representation of function as power series
    - Parametric and polar curves
    - Probability and the central limit theorem (time-permitting)
- Chemistry
    - Gases: ideal gases, gas stoichiometry, kinetic molecular theory
    - Thermodynamics: heat and work, calorimetry
    - Thermochemistry: enthalpy, entropy, free energy
    - Equilibrium: equilibrium constant, solubility, weak acids/bases, buffers
    - Electrochemistry: redox, voltaic cells, electrolytic cells, batteries
    - Kinetics: rates and rate laws, Arrhenius theory, mechanisms
- Physics
    - Energy: units of measurement, laws of thermodynamics, Joule's experiment
    - Electricity: electric fields, point charges and dipoles, potential difference
    - Circuits: voltage, current, Ohm's Law, power, capacitance
    - Waves: SHM, wave parameters, energy, superposition
    - Magnetism: motion of charged particles, magnetic flux, Faraday's and Lenz's laws
- Computer science
    - Variable types: primitive types, containers
    - Conditionals and loops: truth tables, if-else statements, while loops, for loops
    - Functions: variable scope, return statements, recursion
    - I/O: reading from files, writing to files, user input, exception handling
    - Machine learning: supervised and unsupervised methods
    - Visualizations: graphs, plots, image processing

# *Evaluation*

## Breakdown by Subject

The overall course grade will be calculated out of 200 points. Of the 200 points, 91.5 will be based on various deliverables (assignments, lab reports, etc.), while the remaining 108.5 points will be based on formal, written tests and exams. The grade submitted to the Registrar at the end of the term will be expressed as a percentage of the 200 points.

The 200 points are allocated to the various subject areas in 1001X according to the following table. (These allocations are subject to change in the event that COVID-19 makes operational adjustments necessary.) At the end of the term, you will receive your course grade based on the 200 points as well as the points earned in each of the subject areas.

| **Subject** | **Deliverables** | **Tests/Exams** | **Total** |
|---|---|---|---|
| Astronomy | 6 | 4 | 10 |
| Biology | 13 | 17 | 30 |
| Chemistry | 14 | 26 | 40 |
| Computer Science | 18 | 2 | 20 |
| Earth Sciences | 13.5 | 6.5 | 20 |
| Mathematical Sciences | 12.5 | 27.5 | 40 |
| Physics | 14.5 | 25.5 | 40 |
| **Total** | **91.5** | **108.5** | **200** |

The points within each subject are allocated to the four questions, but not necessarily with equal weight. Please see the "master schedule" on OWL that shows the approximate dates and point values for the various components.

## Deliverables

Deliverables include assignments, exercises, lab reports, and all other learning and assessment activities *other than* formal tests and exams.

Unless otherwise stated, deliverables that are submitted past the deadline will incur a penalty of 20% of the full value of the deliverable. An additional 20% penalty will apply for each additional day that the deliverable is late.

## Tests and Exams

Formal tests and exams, and their approximate dates, are listed below. These are also found in the "master schedule" on OWL.

- One 50-minute, in-class math test on Thursday, February 4
- One 110-minute, in-class test on Question #1 on Monday, February 8
- One 50-minute, in-class Comp Sci test on Wednesday, February 10
- Midterms: chemistry on Monday, March 1; physics on Tuesday, March 2; "other" on Friday, March 5; and math on Tuesday, March 9
- One 110-minute, in-class test on Question #2 on Wednesday, March 17
- One 50-minute, in-class math test on Friday, March 26
- Four 3.0-hour cumulative final exams to be scheduled by the Registrar during the April exam period. The four exams are math, chemistry, biology, and physics, and they will be at the same time as the exams for Bio 1002B, Calc 1301B, Chem 1302B, and Physics 1302B. These times will *not* appear on your exam schedule, so we will provide more details as they become available.

# Requirements for Passing Course

**To obtain credit for 1001X as a whole, all three requirements below must be met:**

1. Obtain a minimum of 50% on the overall course grade.
2. Obtain a minimum of 50% on the total of all of the points associated with lab activities.
3. Obtain credit for the chemistry, biology, physics, and math components of 1001X, as described below.
    a. Obtain at least 50% of the points allocated to the subject itself.
    b. Obtain at least 50% of the points associated with the laboratory activities in that subject, if that subject has laboratory activities.
    c. Miss, whether excused or not, no more than one-third of the laboratory activities associated with the subject, if that subject has laboratory activities.
    d. Obtain at least 40% of the points associated with final exam in that subject.

Students who fail to meet requirement #2 will receive a course grade no greater than 40% (even if the calculated course grade is higher) and will not receive credit for 1001X.

Students who fail to meet requirement #3 will receive a course grade no greater than 40% (even if the calculated course grade is higher) and will not receive credit for 1001X. However, these students may take, in the summer of 2021, the traditional first-year course that most closely aligns with the subject for which credit in 1001X was not obtained. The grade obtained in the traditional course will be used to calculate a new 1001X grade. The eligible traditional courses are Chem 1302B, Physics 1302B or 1502B, Calculus 1301B or 1501B, and Biology 1002B.

# Other notes

A missed experiment is assigned a mark of zero unless it has been "excused" (see section on Missed Course Components).

Students who arrive late for an in-person lab will be required to perform the online alternative. Note that there is no penalty, aside from missing out on the in-person experience.

Audience response systems ("clickers") may be used to collect information during class. The data collected using the devices will not be used for research purposes without your consent.

Aside from a calculator, no other electronic devices (phones, iPods, etc.) may be in your possession during tests and exams, even for timekeeping purposes.

# Missed Course Components and Late Deliverables

If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. Approval can be granted either through a self-reporting of your absence or via the Dean's Office or Academic Counselling unit of your home faculty or affiliated college.

Students will have up to two opportunities during the regular academic year to use an online portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are not able to use the self-reporting option in the following circumstances:

- For exams scheduled by the Office of the Registrar (e.g., December and April exams)
- Absence of a duration greater than 48 hours,
- Assessments worth more than 30% of the student's final grade
- If a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate (SMC) if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their faculty's academic counselling office to obtain more information about the relevant documentation. The Student Medical Certificate can be found at: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of your faculty.**

If you are a science student, the Academic Counselling Office of the Faculty of Science is located in NCB 280, and can be contacted at 519-661-3040 or scibmsac@uwo.ca. Their website is: https://www.uwo.ca/sci/counselling/

For more information, please consult Western's policy on academic consideration for absences: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf

## Missed Labs

There are no make-up in-person labs, and it is not possible to reschedule them.

If you are unable to attend an in-person lab, simply complete the online alternative prior to the deadline. No approval of the absence for the in-person lab is required. In other words, if you are able to do the online alternative, do that instead of using up one of your two opportunities to file a self-reported absence.

If you are unable to complete an online alternative prior to the deadline, the weight of the missed lab will be shifted onto all of the other labs of the same discipline. An approved absence, either through the self-reporting system or through your faculty's Academic Counselling Office, will be required. If the absence is not approved, the missed lab will be given a mark of zero.

## Late Deliverables

If your reason for not being able to fulfill an academic commitment on time has been approved, either through the self-reporting system or through your faculty's Academic Counselling Office, your deliverable will be marked without any penalty. Pass/fail tutorial components may be excused instead of a make-up being offered.

## Missed Test or Final Exam

If you are unable to write a test, obtain approval for your absence, either through the self-reporting system or through your faculty's Academic Counselling Office. You will then be able to write a make-up test at a later date. If you are unable to write a make-up test, the weight of the missed test will be shifted to the final exam.

If you are unable to write a Final Exam, contact your faculty's Academic Counselling Office as soon as possible. They will assess your eligibility to write a Special Exam in May.

You may also be eligible to write a Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).