

SYDE 584: Biological and Human Systems – Winter 2021

Instructor: Evelyn Yim (eyim@uwaterloo.ca)

Teaching assistant: Sydney Bell (sm3bell@uwaterloo.ca)

Lecture and Tutorial Time:

Monday 2:30-3:50pm (E5 6006 / Zoom)

Wednesday 8:30-9:50am (E5 6006 / Zoom)

Thursday 1:30-2:20pm (E7 4437 / Zoom)

Before Jan 24 / Contingency plan for remote class: Zoom platform for synchronous sessions on Monday and Thursday; Wednesday session will be asynchronous (pre-recorded and posted.)

Online Office hours: TBD (please email Sydney before the office hour to confirm the schedule)

Course outline:

In this course, students will become familiar with the physiology and anatomical structure of the human body. The structure, functions and properties of some of the major physiological systems (e.g., musculoskeletal, nervous, respiratory and/or cardiovascular) will be presented with an engineering science perspective. Strong emphasis will be given to mechanical, electrical, chemical and biological properties of tissues and their relation to measurements, modeling human systems, and the design of biomedical devices (assistive, orthopedic and diagnostic). Various aspects of physiological system dysfunctions and how they influence measurements and design of models or medical devices will also be introduced.

This course will be taught in part using problem-based learning techniques. Synchronous exercises, discussion, problem solving session will be used throughout the remote learning offering. Where possible, asynchronous learning opportunities will also be made available when students were unable to attend sessions due to unforeseen time conflicts. Students are expected to have completed the assignments and/or requested reading to participate in the topic discussion or problem solving. The course schedule and topics to be covered can be found on page 6.

Course objectives:

- ❖ Learn and integrate basics of human physiology
- ❖ Develop an engineering perspective toward understanding biological function
- ❖ Develop critical thinking skills for solving biomedical problems and designing sound biomedical technologies

By the end of this course, you should be able to

- **Describe** the components/structures of the studied physiological systems
- **Identify** the relationship between structure and functions in physiological systems
- **Interpret** experimental results (graphs, tables) to evaluate the effects of disease or aging on structure and/or function of physiological systems
- **Evaluate** biomedical engineering solutions by applying your knowledge of physiology and the scientific methods
- **Develop** reasoned solutions to address biomedical problems by applying your knowledge of physiology and engineering principles while considering social-economical-ethical impacts

Recommended Textbooks:

Marieb E and Hoehn K. Anatomy and Physiology, 2016. Publisher Pearson Benjamin Cummings.

Bern and Levy. Physiology, 2017. Publisher Elsevier

Anatomy and Physiology. By Betts JG, Desaix P, Johnson E, Johnson JE, Korol O, Kruse D, Poe B, Wise JA, Womble M, Young KA. OpenStax. Rice University. 2017. https://d3bxy9euw4e147.cloudfront.net/oscms-prodcm5/media/documents/AnatomyandPhysiology-OP_xxKlCSo.pdf

Grade breakdown for SYDE 584

| | |
|---|---|
| In-class Quizzes (2) ¹ | 20% |
| Online assignments (5) | 30% (each worth 6% - individual summative assessment) |
| Class activities and participation ² | 10% (formative assessment, group work participation) |
| Mini-project in global health engineering | 5% (group work) |
| Health & technologies connection | 5% (individual assignment) |
| Research and design project ³ | 10% |
| In-person final exam ⁴ | 20% |

¹ In class quizzes will encompass all aspects of the course (lecture, in class problems, assignments, reading materials). The quizzes are mandatory and there are no make-ups, quiz will be held during class or tutorial time (see schedule for dates).

² Throughout lectures and tutorial sessions, small problems and participation activities will be presented. It is expected that at least one participation activity will be run weekly. A simple rubric will be used (see below). The lowest mark in each period will be dropped and the grade will be normalized to 5% for each period.

³ The research & design project is to be done in pair and will relate to the study of a disease and proposing a novel solution to characterize or replace the affected physiological structure or function. More details around project requirement will be provided by week 3.

⁴ The final exam will be open-book (course notes and physiology textbook will be allowed). In the event if in-person final exam will be canceled, the weightage will be distributed to Online Assignments and Research and design project.

Contingency plans (in events of changes in COVID19 safety policy)

In class quizzes Online Quizzes

Quizzes will encompass all aspects of the course (lecture, in class problems, assignments, reading materials). Quizzes will be held in class, but in the case if in-person activity will be suspended for more than 1 week, the online quizzes will run through LEARN. It will be timed and will be available for a specific time period outside synchronous class time. There is no substitute or alternate for failing to submit the online quiz.

Zoom (before Jan 24 or announced date by Faculty of Engineering)

The current plan is to use Zoom as a platform for all online activities. Lectures and tutorials will be recorded and available on Learn. The chat function will also be active and discussion and questions will be answered in this platform. Office hours, if needed, will also be scheduled using this platform.

Prof Yim will make her best efforts to limit the number of different online platforms used in the course.

Assignments

A total of five online assignments will be given during the term. The assignments will include a couple of short answers questions and one short engineering science and design problem requiring some research and synthesis. Assignments will be posted on LEARN approximately 10 days before the due date. Assignments will be submitted using LEARN dropbox and Turnitin®. Feedback will be provided directly in the assigned LEARN dropbox.

Late submission for assignments and project: Give yourself adequate time to finish and submit before the deadline. You will be penalized 1% from your final overall grade per 24-hour period past the deadline, to a maximum of the assigned value. Consideration may be granted if you contact the instructor before the due date.

Class activities

Throughout lectures and tutorial sessions, small problems and participation activities will be presented. It is expected that 1-2 participation activities will run weekly. A simple rubric will be used (see below). The lowest mark in each period will be dropped and the grade will be normalized to 5% for each period (*Period 1: week 1 to 6 and Period 2: week 7 to 13*). There will be some opportunities to complete some of these activities remotely in case you are unable to attend some of the classes. Students are expected to inform Prof Yim if they are unable to attend. For remote classes before January 24: Some activities will be submitted via Learn Dropbox while others may take the form of participating in an online quiz or other online platform.

Rubric for class activities: a simple rubric will be applied. These will be also used by Prof Yim to evaluate comprehension of concepts and common misunderstandings.

0 - Submission missing

0.5 - Submission marginal or missing components: submission has too little work to evaluate or demonstrates an obvious misunderstanding/confusion due to lack of reviewing mandatory materials

1 - Good submission: submission demonstrates a clear effort in applying course concepts and/or critical thinking

Mini-project in global health engineering

On Monday March 14, as a group of 3 or 4 students, you will be working on a global health engineering project. More details will be provided the week prior to the project so as to allow you to form your group and select a topic within the choice of topics provided.

Health & technologies connection

Health and biomedical technologies are in the news weekly and you may also have your own connection or experience with health and biomedical technologies. Every student will get a chance to contribute content around connecting the topics we are discussing in class to what you read/hear in the news or your own experience. This could go beyond specific topics covered in class but needs to relate to physiology, health and biomedical technology. A slide template will be provided later. Contributions will start in week 4. More details about submission schedule will be provided by week 3.

Research and design project

The research & design project is expected to be done in pairs, and it will relate to the study of a disease or aging and proposing a novel solution to characterize, support or replace the affected physiological structure or function. More details around project requirement will be provided in week 3.

Turnitin.com: Text matching software (Turnitin®) will be used to screen assignments and the final project in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin® in this course. It is the responsibility of the student to notify the instructor, in the first week of term or at the time assignment details are provided, if they wish to submit the alternate assignment

LEARN

All communications about the course, including assignment posting, readings, lecture slides will be communicated through LEARN. Emails will be kept at a minimum and thus you are expected to read the announcements on the SYDE584 LEARN site to stay updated about changes, new upload, etc. It is highly recommended that you set up your SYDE 584 LEARN account to email you course announcements.

Slides upload prior to lectures

Efforts will be made to post the slides by 10 pm the day prior to the lecture. Some additional complementary slides will be made available where necessary after the lecture.

Fair Contingencies for Emergency Remote Teaching.

We are facing unusual and challenging times. The course outline presents the instructor's intentions for course assessments, their weights, and due dates in Winter 2022. **As best as possible, we will keep to the specified assessments, weights, and dates.** To provide contingency for unforeseen circumstances, the instructor reserves the right to modify course topics and/or assessments and/or weight and/or deadlines with due and fair notice to students. In the event of such challenges, **the instructor will work with the Department/Faculty to find reasonable and fair solutions that respect rights and workloads of students, staff, and faculty.**

Writing and Communication Centre (WCC)

The Writing and Communication Centre works with students in all Faculties to help you consider your audience, clarify your ideas, develop your voice, and write in the style appropriate to your discipline. We offer one-on-one support for writing papers, delivering presentations, integrating research, and revising for clarity and coherence. Group appointments for team-based projects, presentations, and papers are also available.

All of the services from the WCC are available virtually: booked appointments, drop-ins, resources, and writing groups. Check out their website for other ways to interact with them, such as open online forums and online “Question and Answers”. Visit them at www.uwaterloo.ca/wcc.

Please note that communication specialists guide you to see your work as readers would. They can teach you revising skills and strategies, but will not change or correct your work for you. Please bring your assignment instructions and any notes or drafts to your appointment.

[Link [Writing and Communication Centre](#)]

Course and Departmental Expectations in SYDE

Guiding Principles for our SYDE-BME Community and all students enrolled in SYDE 584:

- 1) Be compassionate (with ourselves and others).
- 2) Be accountable (instructors and students).
- 3) Be patient (with ourselves and others).
- 4) Stay safe and healthy (all of us).

Compassionate and respectful communication

Most online communication between the Department and students will be done through LEARN and/or email. Students are reminded that they should now use their email account name@uwaterloo.ca. Include an academic signature with your full name, program, student ID. We encourage you to include your preferred pronouns (he/him; she/her; they/them).

SYDE-BME comment on accommodation

We respect that our engineering students are independent adult decision-makers, with many opportunities to partake in activities that might be in time conflict with academic deadlines and deliverables. Along with the right to make adult decisions comes the responsibility and accountability for those decisions and any outcomes.

The University of Waterloo’s policy on accommodation for missed deliverables pertains to verifiable health matters, and highly unfortunate events (for example: family tragedies). The Department of Systems Design Engineering follows University of Waterloo’s general policy: students who self-elect to forgo a deliverable receive a “0” for that deliverable. It is preferred practice so that fairness is maintained for members of the same class/course by avoiding preferential treatment, and so that instructors are not burdened with having to create extra quizzes, deliverables, etc. It also reflects professional practice, as failing to show up to work and missing deadlines can be very costly to the company and individual (for example: not submitting a contract proposal, or design review on time). ***Please read the policy here:*** [Link [Accommodation due to illness](#)]

SYDE-BME Academic Priorities over Co-op Interviews

With asynchronous schedules, students should be able to arrange co-op interviews that do not conflict with major deliverables (for example: timed course midterms, final exams). For deliverables with longer time windows (for example: 24-48 hours or more), students must manage their time for deliverables and co-op interviews accordingly. If a co-op interview conflicts with a short deliverable time window (for example: 1-3 hours), then students MUST follow the CECA procedure for rescheduling the interview: [Link [CECA rescheduling co-op interviews](#)]

Compassionate Accommodation

There are times when the Department will make compassionate accommodation for students experiencing circumstances beyond their control or facing challenges that are affecting more than one course. When warranted, Professor Gorbet will coordinate with your Associate Chair Undergraduate (ACUG) or Program Director a reasonable and fair plan in consultation with appropriate others (e.g. Chair, AccessAbility Services, Engineering Counselling services, Registrar's Office).

Online Academic Integrity.

All students are expected to work individually and submit their own original work. Under Policy 71, the instructor may have follow-up conversations with individual students to ensure that the work submitted was completed on their own. Any follow up will be conducted remotely (e.g., MS Teams, Skype, phone), as the University of Waterloo has suspended all in-person meetings until further notice.

Wellness Support and Contact Information.

University can be a challenging environment and it is normal to need support from time-to-time. Campus Wellness services are available to students through counselling and health services. If you are struggling or need someone to talk to you, please reach out. To book an appointment or learn more about the services, call 519-888-4567 x 32655 or explore www.uwaterloo.ca/campus-wellness. If you're experiencing a crisis and feel unable to cope and Campus Wellness is closed, contact any of these after-hours supports: EmpowerMe (1-833-628-5589), Good2Talk (1-866-925-5454) or Here 24/7 (1-844-437-3247). They are available at any time of the day or night to help.

FACULTY OF ENGINEERING – MORE FINE PRINT

Faculty of Engineering website: [[Link Academic Support and Policies](#)].

Academic Integrity

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect, and responsibility.

[Check Academic Integrity website for more information. Link [Office of Academic Integrity](#)].

Discipline

A student is expected to know what constitutes academic integrity (see link above) to avoid committing an academic offence, and to take responsibility for their actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (for example: plagiarism, cheating) or about expectations for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. Relevant documents include:

- University of Waterloo Policy 71 [[Link Policy 71 Student Discipline](#)].
- Academic Penalty Guidelines [[Link Policy 71 Penalty Guidelines](#)].
- Assessment of Unauthorized Collaboration: [[Link Assessment of Unauthorized Collaboration](#)].

Grievance

A student who believes that a decision affecting some aspect of their university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt please be certain to contact the **Associate Chair Undergraduate or Academic Advisor** who will provide further assistance.

[[Link Policy 70 Petitions & Grievance](#)].

Appeals

A decision made, or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes they have a ground for an appeal should refer to Policy 72 (Student Appeals)

[Link [Policy 72 Student Appeals](#)].

Lecture schedule SYDE 584 Winter 2022 - As of Jan 3, 2022 (subject to changes)

| Week | Date | Topic | Assessment - Formative | Assessment - Summative |
|------|-----------------------|---|--|------------------------|
| 1 | January 5 -6 | Overview of Physiology and biological organization Cell structure and tissue | Survey of interest | |
| 2 | January 10-13 | Membrane potential, membrane transport and biological system communications | NaFl problem – concept map around junctions, tissues, permeability | |
| 3 | January 17-20 | From cells to tissues, tissue repair and cell biomechanics | Short reflection on cancer activity | Assignment 1 |
| 4 | January 24-27 | Nervous system 1: nervous tissue and fundamentals | Neuronal transport activity | |
| 5 | Jan 31 – Feb 3 | Nervous system 2: nervous tissue & fundamentals | Designing for brain electrode | Assignment 2 |
| 6 | February 7-10 | Nervous system 3/Musculoskeletal 1: Motor system, muscle structure and function | | Quiz 1 (weeks 1-5) |
| 7 | February 14 - 17 | Musculoskeletal system 2: bone, ligaments, tendons and cartilage | Bone graphs and bone plate activity | Assignment 3 |
| | <i>February 19-27</i> | <i>Reading week</i> | | |
| 8 | Feb 28 – March 3 | Musculoskeletal system 3: muscles and aging | Mechanical properties or TE of tendons | |
| 9 | March 7- 10 | Cardiovascular system 1 – blood and blood vessels | Short activity (15 min) | Assignment 4 |
| 10 | March 14 – 17 | Case study in global health in biomedical engineering | | |
| 11 | March 21 – 24 | Cardiovascular system 2 – the heart | Designing a heart (50 min) | Assignment 5 |
| 12 | March 29-31 | Cardiovascular system 3 – regulation and controls Respiratory system 1 | | Quiz 2 (weeks 6- 12) |
| 13 | April 4 | Respiratory system 2 and COVID-19 | Design solution for COVID- 19 respiratory | |

Additional scientific readings beyond sections of the textbook chapters may be assigned throughout the course.

A list of the specific sections from Marieb / Young may be given as each biological system is presented. Readings may also be posted in announcement section.