Course Outline (W2022)

EES604: Electronics and Sensors

Instructor(s)	Dr. Virgilio Valente [Coordinator] Office: ENG450 Phone: (416) 979-5000 x 553728 Email: vvalente@ryerson.ca Office Hours: Tue 1PM-3PM
Calendar Description	Input-output relationships, transfer functions and frequency response of linear systems; operational amplifiers, operational amplifier circuits using negative and positive feedback; diodes, operational amplifier circuits using diodes; analog signal detection, conditioning and conversion systems; transducers and sensors, difference and instrumentation amplifiers, active filters, transistors including BJT and MOSFET.
Prerequisites	(ELE 202 or EES 512) and (MTH 312 or MTH 425)
Antirequisites	None
Corequisites	None
Compulsory Text(s):	1. Electrical Engineering: Principles and Applications, Allan R. Hambley, 7th Edition, 2016 Prentice Hall: ISBN 978-0-13-4484143.
Reference Text(s):	1. Microelectronic Circuits, A. Sedra and K.C. Smith, 7th Edition, 2016 Oxford University Press: ISBN 978-0-19-933914-3
Learning Objectives (Indicators)	At the end of this course, the successful student will be able to: 1. Use relevant computer simulation and visualization software. (**2b**) 2. Determine the data that are appropriate to collect. Apply mathematical and scientific principles to predict behavior of systems or processes. (**3a**) 3. Understand differences between electronic components and circuit configurations, select a suitable configuration in a design situation and with respect to the specified requirements, and evaluate, simulate, refine, and implement the design. (**4b**) 4. Develop further knowledge of use of modern instrumentation, data collection techniques, and equipment to conduct experiments and obtain valid data. (**5a**) 5. Verify and validate experimental results. (**5b**) **NOTE:** *Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).*
Course Organization	3.0 hours of lecture per week for 13 weeks 2.0 hours of lab per week for 12 weeks 0.0 hours of tutorial per week for 12 weeks

Teaching Assistants	Hanieh Ashrafirad, hanieh.ashrafirad@ryerson.ca Sunjeev Phull, sunjeev.phull@ryerson.ca Robnier Reyes Perez, rreyespe@ryerson.ca
Course Evaluation	**Theory**

Theory	
MidTerm test (25%),	25 %
Final Examination (40%)	40 %
Laboratory	
Labs 1-7 (5% each)	35 %
TOTAL:	100 %

Note: In order for a student to pass a course, a minimum overall course mark of 50% must be obtained. In addition, for courses that have both **"Theory and Laboratory"** components, the student must pass the Laboratory and Theory portions separately by achieving a minimum of 50% in the combined Laboratory components and 50% in the combined Theory components. Please refer to the **"Course Evaluation"** section above for details on the Theory and Laboratory components (if applicable).

Examinations	Midterm exam in Week 7 (scheduled for Tuesday Mar. 1, 2022, 9:00am-11:00am, 2 hours (covers Weeks 1-6 of lecture and lab materials) Final exam, during exam period, 3 hours (covers all the course material).
Other Evaluation Information	None
Teaching Methods	- Zoom live sessions (recorded) with theory, quizzes, tutorials, exercises and simulations. The University has mandated that classes will be held virtually until January 30, 2022 due to the increase in the spread of the Covid Omicron variant. All [your program] courses will be delivered online during January. The University intends to shift back to in-person learning and teaching on January 31, 2022 but this may be subject to change depending on developments with the virus and public health directives.
Other Information	None

Course Content

Week	Hours	Chapters / Section	Topic, description
1	3	3,4,5,6,10	-Review of phasors, complex impedances, first-order circuits -Signals transduction and amplification

			-The voltage amplifier transfer characteristic and circuit model
2-3	6	10,13	-Voltage amplifier -Ideal opamp -Inverting amplifier -Non-inverting amplifier -Difference (differential) amplifier -Instrumentation amplifier
3-4	6	13	-Functions with opamps -Summer -Integrator -Differentiator -First-order active filters
5	3	9	-Diode: circuit symbol characteristic and circuit models -Zener diode and Light-Emitting Diode (LED) -Analysis techniques -Rectifiers and peak detectors -Clippers wave shapers and clampers
6	3	9, Lecture notes	-Non-linear op-amp circuits -"Superdiode" and precision rectifier -Logarithmic and anti-logarithmic amplifiers -Multipliers and dividers
7	2	-	Midterm Exam - Tue March 1, 2022, 9AM-11AM
8-9	6	Lecture notes	-Comparators -Hysteresis and Schmitt Trigger -Square- and triangular-wave signal generators
10-11	6	12	-Bipolar Transistors -Types and circuit symbols -Characteristics and modes of operation -Switching applications -Active mode and DC biasing -Small-signal model and basic amplifiers

	12-13	6	11	-MOSFETs -Types and circuit symbols -Characteristics and modes of operation -Switching applications -H-bridge

Laboratory(L)/Tutorials(T)/Activity(A) Schedule

Week	L/T/A	Description
3	1	Passive RC circuits
4,5	2	Op-Amp Circuits
6	3	Op-Amp Linear Circuit Applications
8	4	Diode Circuits
9	5	Precision Rectifier Circuits
10	6	Single-Stage BJT Amplifiers
11	7	Wheatstone Bridge Sensor

Policies & Important Information:

Students must be reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on the following URL: http://ryerson.ca/senate/course-outline-policies

1. Students are required to obtain and maintain a Ryerson e-mail account for timely communications between the instructor and the students;
2. Any changes in the course outline, test dates, marking or evaluation will be discussed in class prior to being implemented;
3. Assignments, projects, reports and other deadline-bound course assessment components handed in past the due date will receive a mark of ZERO, unless otherwise stated. Marking information will be made available at the time when such course assessment components are announced.
4. Ryerson senate policy 157 requires that any electronic communication by students to Ryerson faculty or staff be sent from their official Ryerson email account.
5. Familiarize yourself with the tools you will need to use for remote learning. The Continuity of Learning Guide for students includes guides to completing quizzes or exams in D2L or Respondus, using D2L Brightspace, joining online meetings or lectures, and collaborating with the Google Suite.

6. The University has issued a minimum technology requirement for remote learning. Details can be found at: https://www.ryerson.ca/covid-19/students/minimum-technology-requirements-remote-learning. Please ensure you meet the minimum technology requirements as specified in the above link.
7. Ryerson COVID-19 Information and Updates (available https://www.ryerson.ca/covid-19/students) for Students summarizes the variety of resources available to students during the pandemic.
8. Refer to our **Departmental FAQ** page for information on common questions and issues at the following link: https://www.ee.ryerson.ca/guides/Student.Academic.FAQ.html.

Missed Classes and/or Evaluations

When possible, students are required to inform their instructors of any situation which arises during the semester which may have an adverse effect upon their academic performance, and must request any consideration and accommodation according to the relevant policies as far in advance as possible. Failure to do so may jeopardize any academic appeals.

1. **Academic Consideration Requests for missed work** (e.g. missing tests, labs, etc) - According to Ryerson Senate Policy 134, sections 1.2.3, if you miss any exams, quizzes, tests, labs, and/or assignments for helth or compassionate reasons you need to inform your instructor(s) (via email whenever possible) in advance when you will be missing an exam, test or assignment deadline. When circumstances do not permit this, you must inform the instructor(s) as soon as reasonably possible "*In the case of illness, a Ryerson Student Health Certificate, or a letter on letterhead from an appropriate regulated health professional with the student declaration portion of the Student Health Certificate attached. For reasons other than illness, proper documentation is also required (e.g. death certificate, police report, TTC report). **ALL supporting documentation for illness or compassionate grounds MUST be submitted within three (3) working days of the missed work.***" __NOTE: You are required to submit all of your pertinent documentation through Ryerson's online Academic Consideration Request system at the following link:__ prod.apps.ccs.ryerson.ca/senateapps/acadconsform.
2. ***Religious, Aboriginal and Spiritual observance*** - If a student needs accommodation because of religious, Aboriginal or spiritual observance, they must submit a Request for Accommodation of Student Religious, Aboriginal and Spiritual Observance AND an Academic Consideration Request form within the first 2 weeks of the class or, for a final examination, within 2 weeks of the posting of the examination schedule. If the requested absence occurs within the first 2 weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these forms should be submitted with as much lead time as possible in advance of the absence. Both documents are available at www.ryerson.ca/senate/forms/relobservforminstr.pdf. **If you are a full-time or part-time degree student, then you submit the forms to your own program department or school;**
3. ***Academic Accommodation Support*** - Before the first graded work is due, students registered with the Academic Accommodation Support office (AAS - www.ryerson.ca/studentlearningsupport/academic-accommodation-support) should provide their instructors with an Academic Accommodation letter that describes their academic accommodation plan.

Virtual Proctoring Information (if used in this course)

Online exam(s) within this course may use a virtual proctoring system. Please note that your completion of any such virtually proctored exam may be recorded via the virtual platform and subsequently reviewed by your instructor. The virtual proctoring system provides recording of flags where possible indications of suspicious behaviour are identified only. Recordings will be held for a limited period of time in order to ensure academic integrity is maintained and then will be deleted.

Access to a computer that can support remote recording is your responsibility as a student. The computer should have the latest operating system, at a minimum Windows (10, 8, 7) or Mac (OS X 10.10 or higher) and web browser Google Chrome or Mozilla Firefox. You will need to ensure that you can complete the exam using a reliable computer with a webcam and microphone available, as well as a typical high-speed internet connection. Please note that you will be required to show your Ryerson OneCard prior to beginning to write the exam. In cases where you do not have a Ryerson OneCard, government issued ID is permitted.

Information will be provided prior to the exam date by your instructor who may provide an opportunity to test your set-up or provide additional information about online proctoring. Since videos of you and your environment will be recorded while writing the exam, please consider preparing the background (room / walls) so that personal details are not visible, or move to a room that you are comfortable showing on camera.

Turnitin (if used in this course)

Turnitin.com is a plagiarism prevention and detection service to which Ryerson subscribes. It is a tool to assist instructors in determining the similarity between students' work and the work of other students who have submitted papers to the site (at any university), internet sources, and a wide range of books, journals and other publications. While it does not contain all possible sources, it gives instructors some assurance that students' work is their own. No decisions are made by the service; it generates an "originality report," which instructors must evaluate to judge if something is plagiarized.

Students agree by taking this course that their written work will be subject to submission for textual similarity review to Turnitin.com. Instructors can opt to have student's papers included in the Turnitin.com database or not. Use of the Turnitin.com service is subject to the terms-of-use agreement posted on the Turnitin.com website. Students who do not want their work submitted to this plagiarism detection service must, by the end of the second week of class, consult with their instructor to make alternate arrangements.

Even when an instructor has not indicated that a plagiarism detection service will be used, or when a student has opted out of the plagiarism detection service, if the instructor has reason to suspect that an individual piece of work has been plagiarized, the instructor is permitted to submit that work in a non-identifying way to any plagiarism detection service.

Academic Integrity

Ryerson's Policy 60 (the Academic Integrity policy) applies to all students at the University. Forms of academic misconduct include plagiarism, cheating, supplying false information to the University, and other acts. The most common form of academic misconduct is plagiarism - a serious academic offence, with potentially severe penalties and other consequences. It is expected, therefore, that all examinations and work submitted for evaluation and course credit will be the product of each student's individual effort (or an authorized group of students). Submitting the same work for credit to more than one course, without instructor approval, can also be considered a form of plagiarism.

Suspicions of academic misconduct may be referred to the Academic Integrity Office (AIO). Students who are found to have committed academic misconduct will have a Disciplinary Notation (DN) placed on their academic record (not on their transcript) and will normally be assigned one or more of the following penalties:

1. A grade reduction for the work, ranging up to an including a zero on the work (minimum penalty for graduate work is a zero on the work);
2. A grade reduction in the course greater than a zero on the work. (Note that this penalty can only be applied to course components worth 10% or less, and any additional penalty cannot exceed 10% of the final course grade. Students must be given prior notice that such a penalty will be assigned (e.g. in the course outline or on the assignment handout);
3. An F in the course;
4. More serious penalties up to and including expulsion from the University.

The unauthorized use of intellectual property of others, including your professor, for distribution, sale, or profit is expressly prohibited, in accordance with Policy 60 (Sections 2.8 and 2.10). Intellectual property includes, but is not limited to:

1. Slides
2. Lecture notes
3. Presentation materials used in and outside of class
4. Lab manuals
5. Course packs
6. Exams

For more detailed information on these issues, please refer to the Academic Integrity policy(https://www.ryerson.ca/senate/policies/pol60.pdf) and to the Academic Integrity Office website (https://www.ryerson.ca/academicintegrity/).

Academic Accommodation Support

Ryerson University acknowledges that students have diverse learning styles and a variety of academic needs. If you have a diagnosed disability that impacts your academic experience, connect with Academic Accommodation Support (AAS). Visit the [AAS website](#) or contact aasadmin@ryerson.ca for more information.

Note: All communication with AAS is voluntary and confidential, and will not appear on your transcript.

Important Resources Available at Ryerson

1. The Library (https://library.ryerson.ca/) provides research workshops and individual assistance. If the University is open, there is a Research Help desk on the second floor of the library, or go to https://library.ryerson.ca/workshops

2. Student Learning Support (https://www.ryerson.ca/student-life-and-learning/learning-support/) offers group-based and individual help with writing, math, study skills and transition support, as well as resources and checklists to support students as online learners (https://www.ryerson.ca/student-life-and-learning/learning-support/).

3. You can submit an Academic Consideration Request (https://prod.apps.ccs.ryerson.ca/senateapps/acadconsform) when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill and academic requirement. You may always visit the Senate website (https://www.ryerson.ca/senate/) and select the blue radial button on the top right hand side entitled: Academic Consideration Request (ACR) to submit the request.

   Policy 167: Academic Concideration due to COVID-19: Students that miss an assessment due to cold or flu-like symptoms, or due to self isolation, are currently not required to provide a health certificate. Other absences must follow [Policy 167: Academic Consideration.](#)

   Also NOTE: Outside of COVID-19 symptoms, the new Policy 167: Academic Consideration does allow for a once per term academic consideration request without supporting documentation if the absence is less than 3 days in duration and is not for a final exam/final assessment. In the absence is more than 3 days in duration and/or is for a final exam/final assessment, documentation is required. For more information please see Senate [Policy 167: Academic Consideration](#).

4. Ryerson COVID-19 Information and Updates for Students (https://www.ryerson.ca/covid-19/students/) summarizes the variety of resources available to students during the pandemic.

5. Familiarize yourself with the tools you will need to use for remote learning. The Continuity of Learning Guide (https://www.ryerson.ca/centre-for-excellence-in-learning-and-teaching/learning-guide/) for students includes guides to completing quizzes or exams in D2L Brightspace, with or without [Respondus LockDown Browser and Monitor](#), [using D2L Brightspace](#), joining online meetings or lectures, and collaborating with the Google Suite.

6. Information on Copyright for Faculty (https://library.ryerson.ca/copyright/faculty/copyright-faqs/my-teaching-materials-have-been-posted-online/) and students (https://library.ryerson.ca/copyright/home/copyright-for-students-2/students-course-sharing-websites-and-file-sharing/).

7. At Ryerson, we recognize that things can come up throughout the term that may interfere with a student's ability to succeed in their coursework. These circumstances are outside of one's control and can have a serious impact on physical and mental well-being. Seeking help can be a challenge, especially in those times of crisis. Below are resources we encourage all Ryerson community members to access to ensure support is reachable. https://www.ryerson.ca/mental-health-wellbeing.

   If support is needed immediately, you can access these outside resources at anytime:
   - **Distress Line** - 24/7 line for if you are in crisis, feeling suicidal or in need of emotional support (phone: 416-408-4357)
   - **Good2Talk** - 24/7 hour line for postsecondary students (phone: 1-866-925-5454)