

Course Outline (F2022)

ELE504: Electronic Circuits II

Instructor(s)	Dr. Mike Kassam [Coordinator] Office: ENG470 Phone: (416) 979-5000 x 556103 Email: mkassam@ryerson.ca Office Hours: Refer to Course Webpage (D2L)
Calendar Description	Advanced course on the analysis and design of electronic circuits. Topics include non-ideal Op-Amp amplifier characteristics, practical amplifier designs, linear/non-linear Op-Amp circuits, filters and tuned amplifiers, oscillators, signal generators, power output stages, etc. Circuit applications to such areas as instrumentation, signal processing and conditioning, and control are considered. Key design concepts are experienced through laboratory work and a major design project, use of electronic circuit simulation tools, and solving design problems.
Prerequisites	ELE404
Antirequisites	None
Corerequisites	None
Compulsory Text(s):	1. Microelectronic Circuits, Sedra and Smith, 6th, 7th or 8th edition, Oxford University Press. (Same textbook as was required for ELE404 course)
Reference Text(s):	1. Operational Amplifiers with Linear Integrated Circuits, 4th edition, Stanley, Prentice- Hall. 2. Basic Operational Amplifier and Linear Integrated Circuits, Floyd and Buchla, 2nd Edition.
Learning Objectives (Indicators)	At the end of this course, the successful student will be able to: <ul style="list-style-type: none"> 1. Analyze, design and implement use of Op-Amp based linear/non-linear electronic circuits to solve engineering problems. Understand, and effectively use, engineering principles and theories to formulate design problems (issues) based on the required specifications and/or functionalities. (4a), (4b) 2. Use analysis, modeling and design simulation/development tools to seek, and decide on, optimal design solution(s). (4c) 3. Use of engineering tool (MultiSim Electronics Circuit Simulator) to allow verification of design/problem analysis through use of real devices'™ simulation models. (5a) 4. Demonstrate the main design features of the Major-Project and answer critical and project specific questions during project demo and oral sessions. Write a formal technical report (following the prescribed template and guidelines) reflecting the design process used for the Major Project (MP), where all the reports are evaluated based on their completeness, technical content and proper use of the English language. (7a) <p>NOTE: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).</p>

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	Daniel Junehee Lee (danieljunehee.lee@ryerson.ca) - Lead TA Ian Perczak (iperczak@ryerson.ca) Wiley Tam (wiley.tam@ryerson.ca)																										
Course Evaluation	<table border="1" data-bbox="428 361 1351 1087"> <thead> <tr> <th colspan="2" data-bbox="428 361 1351 415">Theory</th> </tr> </thead> <tbody> <tr> <td data-bbox="428 415 1175 470">Midterm Exam</td> <td data-bbox="1175 415 1351 470">25 %</td> </tr> <tr> <td data-bbox="428 470 1175 525">Final Exam</td> <td data-bbox="1175 470 1351 525">40 %</td> </tr> <tr> <th colspan="2" data-bbox="428 525 1351 579">Laboratory</th> </tr> <tr> <td data-bbox="428 579 1175 634">Lab 1</td> <td data-bbox="1175 579 1351 634">3 %</td> </tr> <tr> <td data-bbox="428 634 1175 688">Lab 2</td> <td data-bbox="1175 634 1351 688">3 %</td> </tr> <tr> <td data-bbox="428 688 1175 743">Lab 3</td> <td data-bbox="1175 688 1351 743">3 %</td> </tr> <tr> <td data-bbox="428 743 1175 798">Major Project (MP)</td> <td data-bbox="1175 743 1351 798">14 %</td> </tr> <tr> <td data-bbox="428 798 1175 852">Lab 4</td> <td data-bbox="1175 798 1351 852">3 %</td> </tr> <tr> <td data-bbox="428 852 1175 907">Lab 5</td> <td data-bbox="1175 852 1351 907">3 %</td> </tr> <tr> <td data-bbox="428 907 1175 961">Lab 6</td> <td data-bbox="1175 907 1351 961">3 %</td> </tr> <tr> <td data-bbox="428 961 1175 1016">Lab 7</td> <td data-bbox="1175 961 1351 1016">3 %</td> </tr> <tr> <td data-bbox="428 1016 1175 1071">TOTAL:</td> <td data-bbox="1175 1016 1351 1071">100 %</td> </tr> </tbody> </table> <p data-bbox="311 1142 1466 1323">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).</p>	Theory		Midterm Exam	25 %	Final Exam	40 %	Laboratory		Lab 1	3 %	Lab 2	3 %	Lab 3	3 %	Major Project (MP)	14 %	Lab 4	3 %	Lab 5	3 %	Lab 6	3 %	Lab 7	3 %	TOTAL:	100 %
Theory																											
Midterm Exam	25 %																										
Final Exam	40 %																										
Laboratory																											
Lab 1	3 %																										
Lab 2	3 %																										
Lab 3	3 %																										
Major Project (MP)	14 %																										
Lab 4	3 %																										
Lab 5	3 %																										
Lab 6	3 %																										
Lab 7	3 %																										
TOTAL:	100 %																										
Examinations	Midterm Exam in Week 7 during class hours for 1hr:50min., closed book (covers course materials in Weeks 1 to 6/7). Final Exam, 3hrs duration, closed-book (covers course materials from Weeks 1 to 13).																										
Other Evaluation Information	<p data-bbox="311 1549 1438 1642">Midterm Exam:- A single Midterm Exam will be held. No make-up exam will be provided for missing the Midterm Exam for a valid reason, instead its weight will be shifted to the Final Exam for eligible cases.</p> <p data-bbox="311 1671 1466 1818">Labs & Major Project(MP):- The Pre-Lab (Analysis & Simulations) for each lab and Major Project Milestones are to be done INDIVIDUALLY and submitted by each student via D2L, whereas the In-Lab work will be done in LAB GROUPS of up to 2 students per Lab Group and the weekly Lab Report is to be done and submitted as a GROUP. The specific deliverables and Lab/MP marking schemes are provided in each Lab/MP description available on the ELE504 course website (D2L).</p> <p data-bbox="311 1848 1466 1999">Missed In-Lab Work:- A student who misses any scheduled In-Lab work for a valid reason (per Policy 167) will be given a make-up opportunity to complete the missed In-Lab work on their own based on the student's own Pre-Lab assignment, and followed with the required Lab Report submission by the student. The make-up lab schedule will be arranged by the Instructor on a case by case basis.</p>																										

Teaching Methods	The lecture and labs will be 100% in-person. Past lecture notes will be made available on D2L.
Other Information	<p>(1) LAB KIT: ELE504 lab kit should be purchased individually, and not per lab group. Most of the Labs/MP will require some components from your previous ELE404 Kit to supplement the ELE504 Kit. labs/MP. It is each student's responsibility to have all required circuit components available prior to the start of each lab.</p> <p>(2) MULTISIM: Students are required to use ONLY the Ryerson's licensed V14.2 version (or the most recent version) of the MultiSIM Simulator. Zero mark will be awarded for the Lab/MP submission that uses either an incorrect version, or the on-line freeware version, of MultiSIM. Download instructions are posted on the ELE504 course website (D2L). There is no charge to the student for use of this licensed version of MultiSIM.</p>

Course Content

Week	Hours	Chapters / Section	Topic, description
1 - 3	8		Chapter 2: Operational Amplifiers (Op-Amp) Ideal Op-Amp and Applications review (Section 2.1-2.3) Difference Amplifiers (Section 2.4) Non-Ideal Op-Amp (Sections 2.6-2.8) - DC imperfections - Finite open-loop gains and bandwidths - Large signal operations Integrators and Differentiators (Section 2.5) Practical Applications (notes)
3-7	10		Chapters 4 and 18: Waveform Shaping Circuits Section 18.4: Bistable Multivibrators Section 18.5: Square and Triangular waveform generations Section 4.5: Basic Rectifier and Superdiode Notes: Precision Rectifier Circuits Sections 18.6-7: Pulse Generation and Integrated-Circuit Timers Notes: Practical Applications
7	2		Midterm Exam
8-10	8		Chapter 18: Signal Generation Section 18.1: Oscillation principles Section 18.2: Op-amp-RC Oscillators Section 18.3: LC and Crystal Oscillators Notes: Practical Applications
10-13	7		Chapter 17: Active Filters Section 17.1-2: Filter Concepts Section 17.3: Notes: Butterworth and Chebyshev Filters

			Section 17.4: Notes: Filter Design Implementation using second order Sallen Key Circuits Section 17.9: Sensitivity analysis
12-13	2		Suppl. Notes: Single-Supply Op-Amps Circuit Design Techniques
13	2		Chapter 11: Power Output Stages for Op-Amp Amplifiers Section 11.1: Class A Section 11.3: Class B Section 11.4: and notes Class AB

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

Week	L/T/A	Description
1	---	No Lab Scheduled. Each lab group should purchase the ELE504 Lab KIT before the next lab. Refer to D2L.
2	In-Person	L1: Select Op-Amp Circuits (Review)
3	In-Person	L2: Part I - Non-ideal Op-Amp Characteristics
4	In-Person	L3: Part II - Practical Audio Amplifier Design
5-9	In-Person	MP (Major Project): Design of Voltage Controlled Frequency Generator (VCFG)
10	In-Person	L4: Precision Rectifier Circuits
11	In-Person	L5: Part I - 555 Timer Circuits - Monostable & Astable Applications
12	In-Person	L6: Part II - Oscillator Circuits

13	In-Person	L7: Active Filter Designs
----	-----------	---------------------------

Policies & Important Information:

Students are reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on [the Senate website](#)

1. In accordance with the Policy on TMU Student E-mail Accounts (Policy 157), Toronto Metropolitan University (TMU) **requires** that any electronic communication by students to TMU faculty or staff be sent from their official university email account;
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. 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.
5. The University has issued a minimum technology requirement for remote learning. Details can be found at: <https://torontomu.ca/covid-19/students/minimum-technology-requirements-remote-learning>. Please ensure you meet the minimum technology requirements as specified in the above link.
6. Toronto Metropolitan University COVID-19 Information and Updates (available <https://www.torontomu.ca/covid-19/students>) for Students summarizes the variety of resources available to students during the pandemic.
7. Refer to our **Departmental FAQ** page for information on common questions and issues at the following link: <https://www.ecb.torontomu.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 [Senate Policy 134](#), Section 1.2.3, if you miss any exams, quizzes, tests, labs, and/or assignments for health 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 [Toronto Metropolitan 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 the University's online Academic Consideration Request system at the following link: <prod.apps.ccs.ryerson.ca/senateapps>.***
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.torontomu.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 - <prod.apps.ccs.ryerson.ca/senateapps>) 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 Toronto Metropolitan University OneCard prior to beginning to write the exam. In cases where you do not have a Toronto Metropolitan University 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.

Academic Integrity

Toronto Metropolitan University'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.

Suspicious 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 and 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.torontomu.ca/senate/policies/pol60.pdf>) and to the Academic Integrity Office website (<https://www.torontomu.ca/academicintegrity>).

Academic Accommodation Support

Toronto Metropolitan 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 Toronto Metropolitan University

1. [The Library](#) 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 students can use the Library's virtual research help service at <https://library.torontomu.ca/ask> to speak with a librarian.
2. [Student Life and 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](#).
3. You can submit an [Academic Consideration Request](#) when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill an academic requirement. You may always visit the [Senate website](#) and select the blue radial button on the top right hand side entitled: Academic Consideration Request (ACR) to submit this request).

Please note that the Provost/Vice President Academic and Deans approved a COVID-19 statement for Fall 2022 related to academic consideration. This statement will be built into the Online Academic Consideration System and will also be on the [Senate website \(www.ryerson.ca/senate\)](http://www.ryerson.ca/senate) in time for the Fall term:

Policy 167: Academic Consideration for Fall 2022 due to COVID-19: Students who miss an assessment due to cold or flu-like symptoms, or due to self-isolation, are required to provide a health certificate. All absences must follow Senate [Policy 167: Academic Consideration](#).

Also NOTE: 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**. If 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. [TMU COVID-19 Information and Updates for Students](#) summarizes the variety of resources available to students during the pandemic.
5. [TMU COVID-19 Vaccination Policy](#).
6. If taking a remote course, familiarize yourself with the tools you will need to use for remote learning. The Remote 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.
7. Information on Copyright for [students](#).
8. At Toronto Metropolitan University (TMU), 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.

If you are experiencing a mental health crisis, please call 911 and go to the nearest hospital emergency room. You can also 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)
- **Keep.meSAFE:** 24/7 access to confidential support through counsellors via My SSP app or 1-844-451-9700

If non-crisis support is needed, you can access these campus resources:

- Centre for Student Development and Counselling: 416-979-5195 or email csdc@ryerson.ca

- Consent Comes First - Office of Sexual Violence Support and Education: 416-919-5000 ext: 553596 or email osvse@ryerson.ca

We encourage all Toronto Metropolitan University community members to access available resources to ensure support is reachable. You can find more resources available through the [Toronto Metropolitan University Mental Health and Wellbeing website](#).