GEORGIA TECH LORRAINE GEORGIA INSTITUTE OF TECHNOLOGY

School of Electrical and Computer Engineering

ECE 2040
Circuit Analysis
Fall Semester 2020

Course Description
Basic concepts of DC and AC circuit theory and analysis.

Prerequisites ECE 2025, PHYS 2212 PHYS 2232 MATH 2552.


Office Hours: TBD or send an email to set an appointment

Course Outcomes
Upon successful completion of this course, students should be able to:

- analyze small RLC circuits by hand.
- use network techniques, like node analysis and loop analysis, to write equations for large linear circuits.
- apply Thevenin and Norton theorems to analyze and design for maximum power transfer.
- apply the concept of linearity and the associated technique of superposition to circuits and networks.
- analyze circuits containing ideal operational amplifiers.
- explain the concept of steady state.
- apply phasor analysis to AC circuits in sinusoidal steady state.
- analyze the frequency response of circuits containing inductors and capacitors.
- construct simple Bode plots for first- and second-order circuits.
- apply the Laplace transform to linear circuits and systems.
- analyze simple two-port circuits.

Topical Outline
1. Basic Concepts
   a. Voltage, Current, Power and Energy
   b. Circuit elements (R, L, C, ideal operational amplifiers, ideal transformer)
   c. Independent and Dependent Sources
   d. Kirchhoff’s Laws
   e. Series and Parallel Combinations of Elements
   f. Voltage Division and Current Division
2. DC circuit analysis
   a. Node Analysis
   b. Mesh Analysis
3. Network Theorems
   a. Linearity
   b. Superposition
   c. Source Transformations
   d. Thevenin's Theorem
   e. Norton's Theorem
4. Circuits Containing Operational Amplifiers
   a. Ideal Op Amp model, with negative feedback condition
   b. Inverting and Non-Inverting Configurations
   c. Voltage Followers, Adders, Difference Amplifiers
5. First and Second-Order Circuits
   a. Singularity Functions
   b. RC and RL Source-Free Circuits
   c. Constant and Non-Constant Forcing Functions
   d. Initial and Final Values
   e. Op-amp circuits for integration and differentiation
   f. Measurement of signals in physical circuits
   g. RLC circuits
   h. Time-Domain Analysis

6. Sinusoidal Steady-State (SSS) Analysis
   a. Sinusoids
   b. Complex Numbers
   c. Complex Exponential Representations of Sinusoids (Phasors)
   d. Impedance and Admittance
   e. Superposition, Thevenin???s and Norton???s Theorems
   f. Analysis and Network Theorems for SSS
   g. Frequency response
   h. Bode plots
   i. Resonance
   j. Measurement of frequency response of physical circuits

7. Power Analysis
   a. Instantaneous and Average Power
   b. Power Factor and Power Factor correction
   c. Complex Power
   d. Maximum Power Transfer

Lectures This course is 3 SCH. Lectures are 1:20 hour, scheduled TBD.

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Class Attendance Class attendance is mandatory! GTL classes are small so class is a great time to ask questions or to get clarifications. Participation in lectures will be an important way to stay engaged with the course. For more information about class attendance at Georgia Tech, you may go to http://www.catalog.gatech.edu/rules/4/.

Honor code GT Academic Honor Code is strictly enforced at GT Lorraine. Adherence to the Georgia Tech Honor Code is expected and all suspected instances of academic misconduct will be reported to the Dean of Students. It is your responsibility to ask for clarification if collaboration guidelines, test-taking policies, etc. are not clear. You will find detailed information at http://osi.gatech.edu/content/honor-code.

Grading The course grade will be computed according to the following weights:
Tests (2): 40 %
Final exam: 40 %
All HW turned in: 20 %

Student-Faculty Expectations Agreement At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectation that you can have of your Instructor and that he has of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, you are encouraged to remain committed to the ideals of Georgia Tech while in this class.

Major Emergencies If you have some sort of major life emergency - serious illness or injury, death in the family, etc. - that seriously impedes your progress in the class, please let know your Instructor as soon as possible so something can be worked out. Don’t disappear with no warning half way through, making think that you dropped the class, and then reappear out of nowhere the week before finals asking what you can do to make things up.
**Disabilities** Georgia Tech offers accommodation to students with disabilities, this policy is extended to GT Lorraine. If you need any accommodation, then inform your Instructor and Mrs Corinne Guyot with a certificate from the Office of Disability Services.

**Miscellaneous** In classroom, the cellphone is turned off or in Do Not Disturb or Airplane mode, no food or drink during class time. You can use your laptop to take notes but not for gaming.

**Assignments** Assignments and solutions will be posted periodically on Canvas.

**Important dates:** A tentative calendar is proposed below:

- First day of class: August 18, 2020
- GT-L recess: October 26 to 30, 2020
- Last day of class: December 1, 2020
- Final Exam: December 3 to 10, 2020