EE-120 **Computer Tools** **Fall 2024**

Catalog Description Computer Tools is a first semester introduction to designing, building, and analyzing electrical circuits with the aid of MATLAB and Spice circuit simulation. MATLAB is used for basic scalar and matrix computations involving circuit behavior, graphical display of circuit variables, and as a programming language. Spice is used to analyze both static DC operating points and time-varying circuit behavior. Required course.

Pre/co-requisites None. This is an introductory course designed for first-semester freshmen.

Textbook

Required: *Programming for Electrical Engineers*, James Squire and Julie Brown, ISBN 978-0128215029. Direct purchase link on Canvas, or www.jimsquire.com under Teaching EE120, or the bookstore.

Optional: *LTSpice*, free. Google LTSpice; it is under the Analog Devices website.
MATLAB, free for VMI students at the barracks help desk.

Instructor COL James Squire, NEB 509. Main website: Canvas. Backup website: **jimsquire.com**
Email: squirejc@vmi.edu Office tel: x7548 Home tel: 540-264-0122 Cell: 540-461-2737

Office hours: M, F 1100-1150. Sometimes you simply need to see me in person, but you can get answers **far faster** by email. I answer emails very quickly, usually within 60 minutes.

Course schedule (2) 75 minute lectures each week
Section 01: NEB 404 TR 0800 – 0915
Section 02: NEB 404 TR 0925 – 1040

Student Outcomes

a. Students will be able to use MATLAB to solve algebraic problems involving given equations such as Ohm's law, voltage divider law, equivalent parallel resistance, and RC filter design equations.
b. Students will be able to use MATLAB to solve phasor problems using complex numbers.
c. Students will be able to build and manipulate matrices and vectors, and use these to solve simultaneous equations such are encountered when solving mesh circuits.
d. Students will be able to plot the simulated oscilloscope response of circuit variables.
e. Students will be able to write MATLAB programs that solve well-defined electrical engineering problems including:
    1) Simulated digital logic structures
    2) Voltage divider equations.
    3) Filter design
    4) Mesh analysis problems.
f. Students will be able to debug programs using a modular approach.
g. Students can use SPICE to model the DC behavior of a circuit composed of voltage sources and wires.
h. Students can use SPICE to model the time-varying behavior of a circuit with integrated circuit (IC).

Topics

Chapter	Concept
1	Introduction to MATLAB
2	MATLAB as a Circuit Calculator
3	MATLAB as a Circuit Response Plotter
4	MATLAB as a Programming Language I
5	MATLAB as a Programming Language II
6	Circuit Analysis with SPICE

Calendar

See Canvas or https://jimsquire.com for latest calendar. Be aware – when scheduling conflicts occur, classes will be made up **in advance** during Dean's Evening Hour, which is from 1945-2100 in NEB404.

Grading

Problem Sets from Chapter	%
1 (individual)*	12
2 (team)*	12
3 (individual)	12
4 (team)*	12
5 (team)*	12
6 (team)*	12
Final Exam (individual)	30
Class participation	10
Total	100

* I will drop the lowest of the Problem Set grades, other than your individual grade from Module 3. 14 x 5 + 30 = 100

There are six topic chapters, each spanning about 2 weeks. Chapters have both embedded *Practice Problems*, due every class on Canvas by Taps of that class day, and *Lab Problems* at the end of each chapter due on Canvas on Friday by Taps on the dates shown in the table on the previous page. Class participation, besides contributing the class discussion, also includes student performance on the *Practice Problems*.

Most of your grade hinges on the *Lab Problems.* Labs 1 and 3 are individual; Labs 2, 4, 5, and 6 are in teams of 2 that are assigned and change each time. **Teamwork is not optional; if a student chooses not to use the assigned lab partner, both lab partners' submissions will be reduced by 20%. This is because learning to work in teams is a vital part of engineering and is a difficult skill not generally taught in high school assignments.** Do not wait to start the lab until the week before it is due or you may have trouble coordinating to meet with your lab partner. If your lab partner is no longer enrolled in the ECE program, you have the option to join any other 2-person lab group of your choosing. The lowest lab grade from labs 1, 2, 4, 5, 6 will be dropped from the average for the final class grade, but not for the mid-semester (temporary) grade. This should reduce the fear some students have of needing to be perfect – now you can forget one, or do horribly in one, or be sick or have something come up, and not have it affect your grade. Think of it as one get-out-of-jail-free card.

Collaboration on the daily *Practice Problems* is expected and encouraged, and must be documented in your Help Received statement but will not affect your grade. Collaboration on the *Lab Problems* is expected within each group, but is not authorized between groups. Help given from one set of partners to a different set of partners must be described in Help Received, **and both the giving and receiving parties will receive 0 credit for the problems that were collaborated on**. Partners do not need to credit Help Received from each other, from the instructor, from their calculators, calculator manuals, their class textbooks, from the built-in Help functions in MATLAB, or from any handout or notes given in class. All other help is not authorized and will not be given credit, but must be documented in the Help Received.

Late policy Daily class problems submitted after Taps receive a zero. Since they make up only a small portion of your overall grade, do not be overly concerned if you miss one or two. I also drop your two lowest class daily class grades. Your solutions to the lab problems are due on Friday Taps, 2330, before the start of the following chapter. Late solutions turned in after Friday taps but before the start of the Tuesday lecture will be accepted at -20%. Solutions will be discussed the following Tuesday lecture, so **no solutions will be accepted once the Tuesday class begins**. Hospitalization and absences for reasons satisfactory to the superintendent will be handled on a case-by-case basis. Scheduled guard duty does not exempt a cadet from turning in the assignment on time. I drop the lowest lab grade, so do not worry if you waited until the last minute and then found yourself caught; instead, learn from the mistake, don't let it happen again, and know you won't be penalized since your zero will be dropped. Practice problems are collected at the end of each class; they do not need to be made up if you miss a class, and are not to be worked on after class ends. You may choose to do them prior to class and then leave early; this can be a good way to manage your time when you know you will have a time conflict (e.g. to allow yourself time to prepare for an exam in the next period).

Professional Component 3 credits of Engineering Topics (specifically, Engineering Science and Design)
Relationship Of Course To Program Outcomes primarily department outcomes 1, 5, 11, 13, 14 and 15.
Prepared by COL James C. Squire, 08/06/24

Appendix A: Institute Work For Grade Policy

"**Work for grade**" is defined as any work presented to an instructor for a formal grade or undertaken in satisfaction of a requirement for successful completion of a course or degree requirement. All work submitted for grade is considered the cadet's own work. "**Cadet's own work**" means that he or she has composed the work from his or her general accumulation of knowledge and skill except as clearly and fully documented and that it has been composed especially for the current assignment. No work previously submitted in any course at VMI or elsewhere will be resubmitted or reformatted for submission in a current course without the specific approval of the instructor.

In all work for grade, failure to distinguish between the cadet's own work and ideas and the work and ideas of others is known as **plagiarism**. Proper documentation clearly and fully identifies the sources of all borrowed ideas, quotations, or other assistance. The cadet is referred to the VMI-authorized handbook for rules concerning quotations, paraphrases, and documentation.

In all written work for grade, the cadet must include the words "**HELP RECEIVED**" conspicuously on the document, and he or she must then do one of two things: (1) state "none," meaning that no help was received except as documented in the work; or (2) explain in detail the nature of the help received. In oral work for grade, the cadet must make the same declaration before beginning the presentation. Admission of help received may result in a lower grade but will not result in prosecution for an honor violation.

Cadets are prohibited from discussing the contents of a quiz/exam until it is returned to them or final course grades are posted. This enjoinder does not imply that any inadvertent expression or behavior that might indicate one's feeling about the test should be considered a breach of honor. The real issue is whether cadets received information, not available to everyone else in the class, which would give them an unfair advantage. If a cadet inadvertently gives or receives information, the incident must be reported to the professor and the Honor Court.

Each cadet bears the responsibility for familiarizing himself or herself thoroughly with the policies stated in this section, with any supplementary statement regarding work for grade expressed by the academic department in which he or she is taking a course, and with any special conditions provided in writing by the professor for a given assignment. If there is any doubt or uncertainty about the correct interpretation of a policy, the cadet should consult the instructor of the course. There should be no confusion, however, on the basic principle that it is never acceptable to submit someone else's work, written or otherwise, formally graded or not, as one's own.

The violation by a cadet of any of these policies will, if he or she is found guilty by the Honor Court, result in his or her being dismissed from VMI. Neither ignorance nor professed confusion about the correct interpretation of these policies is an excuse.

Appendix B: Department Work For Grade Policy

Revised 14 August 2023

Tutoring [e.g. Writing Center, Academic Center, athletic tutors, private tutors]: The ECE Department supports and encourages cadet use of such learning aids, as offered by the VMI Writing Center, VMI Academic Center, and tutors. All assistance from these, and any other similar aids, must be explicitly described in the cadet statement regarding HELP RECEIVED.

Peer Collaboration: Peer collaboration policies, including policies on CRITICAL COMMENTS, will be established by the individual faculty of the ECE Department, and may vary from assignment to assignment. Each ECE faculty member will clearly indicate the appropriate collaboration policy for each assignment. Policy regarding laboratory groups, team cooperation, interaction between teams, etc. will be established by the individual faculty. All assistance from such peer collaboration must be explicitly described in the cadet statement regarding HELP RECEIVED.

Computer Aids [including calculators, translators, spelling, style, and grammar checkers]: The ECE Department supports and encourages cadet use of computer aids, including calculators, translators, spelling, style, and grammar checkers to improve the quality of the cadets' work. The use of such computer aids does not constitute HELP RECEIVED.

Appendix C: Disability Policy

VMI abides by Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 which mandate reasonable accommodations are provided for all students with documented disabilities. If you have a registered disability and may require some type of instructional and/or examination accommodations, please contact me early in the semester so that I can provide or facilitate provision of accommodations you may need. If you have not already done so, you will need to register with the Office of Disabilities Services, the designated office on Post to provide services for cadets with disabilities. The office is located at 207 Carrol Hall in the Miller Academic Center. Please call or stop by the office of LTC Denise Young, Ph.D., Director of Disabilities Services, for more information, 464-7741 or email youngdh125@vmi.edu.