

Course Syllabus

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ECE 5484 | Fundamentals of Computer Systems Summer 2020

Instructor: David McPherson

Course Meta

- Email: [dmcphers@vt.edu \(mailto:dmcphers@vt.edu\)](mailto:dmcphers@vt.edu)
- Zoom: Tuesday 7PM-EST
- ZOOM URL: <https://virginiatech.zoom.us/j/98515289597>
(<https://virginiatech.zoom.us/j/98515289597>)

Course Description

In this foundation course for the Master of Information Technology program the student will learn the essential principles and concepts of computer systems—the components, organization, and interaction of hardware and software found in the smallest wearable computers to the largest parallel systems. The student will also learn how computers communicate with each other and with external devices, how data is represented and stored, and how software instructions are executed.

This course is designed to give every Master of Information Technology student a fundamental understanding of how computers and computer systems work, which is essential for those working in organizations on technical projects or leading those who do. This course will also give you a foundation for further coursework in the Master of Information Technology program.

This course is limited to Master of Information Technology (MIT) students only. Before taking this course, you are expected to have experience in programming and computer use. You should understand how to program in a high-level language such as C, C++, or Java. You need to know enough operating system fundamentals to use online resources, a text editor, and course software. You are also expected to be able to undertake independent design projects.

Course Structure

This is an asynchronous online class. Pre-recorded lectures are available from the course web site. Note that because the instructor and Virginia Tech share copyright, the materials on this course website are only for the use of students enrolled in this course for purposes associated with this course and may not be retained or further disseminated. There will be a weekly synchronous (live) ZOOM session that will be

for Q&A, help with assignments, project introductions, etc. Attending the synchronous sessions is optional. The sessions will be recorded on a best-effort basis for access if a student cannot attend live. The course is divided into 15 lectures. Each lecture typically consists of readings, and lecture videos. A course schedule is provided to keep the class synchronized and to provide assignment, project, and exam deadlines, so please see the Course Schedule page which includes course topics by class period, readings, and assignments.

This course will be conducted as a learning community:

According to Pallof & Pratt (1999), the key elements to the creation of a learning community are honesty, responsiveness, relevance, respect, openness, and empowerment. These will serve as the guides for our community. Therefore, students participating in this course are asked to be open to all perspectives and empowered to be honest in their timely responses to all questions, conversations, and discussions in a manner that is respectful and remains relevant to the topic or topics under discussion.

Palloff, R. M., & Pratt, K. (1999). Building learning communities in cyberspace. San Francisco, CA: Jossey-Bass Inc., Publishers.

Course Objectives

Having successfully completed this course, the student should be able to:

1. Derive logical operations using Boolean operators to solve Boolean algebra problems.
2. Represent numeric and non-numeric data using standard encoding methods.
3. Analyze and design simple logic circuits given combinational and sequential logic problems.
4. Explain the basic components, functionality, and organization of a digital computer given simple computer architecture problems and simulations.
5. Apply the principles of operation of von Neumann computer architectures to solve representative component specification and computer performance problems.
6. Analyze software instruction formats and explain the fetch, decoding, and execution of standard instructions.
7. Analyze the relationship between system hardware, operating system software, and software applications in a digital computer.
8. Explain the operation of synchronous and asynchronous data communications and analyze data streams of standard data communication schemes.
9. Determine the content of network data packets given network protocol packet formats.

Assessment

Homework

Eight homework assignments will consist of problems from the text and problems provided by the instructor. These assignments and problems are designed to help reinforce concepts in the lectures—

working through examples and problems are critical for making sure you really understand the material. Work on homework during the week to help you understand lectures and the text. The GTA will grade selected homework problems. Note: You may discuss general approaches to solving homework problems among yourselves in the online discussion forum. However, your solutions must be your original work. See the section on the Honor Code in this syllabus. It is important that you solve all of the homework problems yourself, because you cannot learn the material by studying correct solutions or by copying them from someone else. To do well on the exams, you must practice the thought processes involved in problem solving.

Projects

There will be four assigned projects related to digital circuit design, assembly programming, and network protocols. These projects will give you opportunities to explore concepts through hands-on, direct experience. Project grades will be based on correctness of operation, efficiency of the design and/or quality of the solution, and completeness and correctness of the documentation. In this regard, it is important for you to produce complete, concise, and well-written reports.

Examinations

There will be a midterm examination and a final examination. The purpose of the exams is to give you the opportunity to demonstrate your understanding of the course material. The midterm exam will be a “take-home” exam in that it will not be timed and does not need to be proctored. The final exam will be taken online and will be timed. A proctor is not needed. Full compliance with the Honor Code is, of course, required for both the midterm and final exams.

Late Work

Late work will be subject to a 10% per day late penalty. Of course, any outstanding circumstances will be taken into consideration. Please communicate with the instructor via email if you think your work may be late.

Total Score/Points

ITEM	PERCENTAGE
Assignments	20%
Projects	30%
Midterm	20%
Final	30%

Final Grades

Final course grades will be determined after all work is completed and graded. Final grades will be based on the following scale:

GRADE	RANGE
A	100% to 93%
A-	93% to 90%
B+	90% to 87%
B	87% to 83%
B-	83% to 80%
C+	80% to 77%
C	77% to 73%
C-	73% to 70%
D+	70% to 67%
D	67% to 63%
D-	63% to 60%
F	< 60%

If you have questions about your performance at any point during the semester, please contact the instructor.

Text

This is the required textbook for the course:

Null, Linda (2018). Essentials of computer organization and architecture. Fifth edition. Burlington, Massachusetts: Jones & Bartlett Learning. ISBN: 978-1-284-12303-6.

The publisher's website provides information about the text:

<http://www.jblearning.com/catalog/9781284123036/>

[\(http://www.jblearning.com/catalog/9781284123036/\)](http://www.jblearning.com/catalog/9781284123036/). This text is available through the Virginia Tech Libraries.

Instructional Materials

You will need the following software for the course:

- The Logisim logic simulator, which you can download for free at:
<http://sourceforge.net/projects/circuit/> [_\(http://sourceforge.net/projects/circuit/\)](http://sourceforge.net/projects/circuit/).
- The MARIE Simulator, which you can download for free at the textbook website:
<http://www.jblearning.com/catalog/9781284123036/>
[\(http://www.jblearning.com/catalog/9781284123036/\)](http://www.jblearning.com/catalog/9781284123036/) (see the "Sample Materials" tab at this website).

- The Wireshark network protocol analyzer, which you can download for free:

<http://www.wireshark.org> [\(http://www.wireshark.org\)](http://www.wireshark.org)

Communication Expectations and Netiquette

Since this is an asynchronous online course, email communication will be a recommended way to communicate with me—I will do my best to respond in a timely manner. That being said, if you email me after 5PM or on the weekend, I may not be able to respond until the next day or the next Monday, respectively. All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. When making a post or sending an email, please sign the email with your first name (or what you prefer to be called) so that others know whom they are talking to. It is not always apparent from your email address. I will send out announcements through Canvas periodically. These will go to your VT email address, so make sure you monitor it. The Discussions Board section of the course website is as a great way to ask general questions and to get to know your fellow students—I encourage you to participate. When posting or emailing in this class, you should:

- Refer to the Core Rules of Netiquette for general guidelines of proper behavior.
- Make posts that are on topic and within the scope of the course material.
- Take your posts seriously and review and edit your posts before sending.
- Be as brief as possible while still making a thorough comment.
- Always give proper credit when referencing or quoting another source.
- Be sure to read all messages in a thread before replying.
- Don't repeat someone else's post without adding something of your own to it.
- Avoid short, generic replies such as, "I agree." You should include why you agree or add to the previous point.
- Always be respectful of others' opinions even when they differ from your own.
- When you disagree with someone, you should express your differing opinion in a respectful, non-critical way.
- Do not make personal or insulting remarks.
- Be open-minded.
- Grading appeals must be submitted in writing by email within two weeks after the assignment, project, or exam is returned. Grading appeals for assignments and projects should be submitted to the GTA. Grading appeals for exams should be submitted to the instructor. Appeals after the two week period will not be considered. In Canvas, you have the ability to customize notifications that will come to your preferred email or cell phone when a new discussion post or announcement arrives. In the upper right hand corner of the Canvas interface click "Settings" then click on the "Notifications" tab on the left. This is a life-saver and I strongly recommend that you do it the first day of class.

Please **do not** use the Canvas message tool to contact me. Often times these messages get overlooked and unanswered. Please **do** email me at: dmcphers@vt.edu (<mailto:dmcphers@vt.edu>) to ensure quick response.

Technology

A working and reliable computer with Internet access is required, as well as access to Canvas (<https://canvas.vt.edu/>) and ZOOM (<https://virginiatech.zoom.us/> [_ \(https://virginiatech.zoom.us/\)_](https://virginiatech.zoom.us/)). Students are responsible for all materials on the Canvas course site. Software required includes the Logisim logic simulator, the MARIE simulator, and Wireshark. Links to these applications can be found in the INSTRUCTIONAL MATERIALS section of the syllabus. For assistance with IT, login, or related computing issues, contact <http://4help.vt.edu> [_ \(http://4help.vt.edu\)_](http://4help.vt.edu) or call 540-231-HELP(4357). Please exhaust all resources available to you before contacting the instructor.

Participation

Participants in this course should expect to spend at least 8-10 hours per week involved in the activities and completion of assignments over the semester. Note however that, depending on your background, you may need to invest more time to understand the material and complete the assignments and projects. This is similar to the time one would invest in a course in a traditional classroom setting. This time invested is an average with some weeks requiring more, some less time to complete all assignments and activities.

Absences

If circumstances prevent participation or timely completion of any homework, project, or exam, students must contact the professor to arrange for adjustments in schedule *in advance of due date and not after completion date has passed*.

Honor Code

“As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do.”

We will be bound by the Graduate Honor Code. Please visit the Graduate School Honor System’s webpage (<https://graduateschool.vt.edu/academics/expectations/graduate-honor-system.html> [_ \(https://graduateschool.vt.edu/academics/expectations/graduate-honor-system.html\)_](https://graduateschool.vt.edu/academics/expectations/graduate-honor-system.html)) for specific information regarding expectations and policies related to the Graduate Honor Code.

Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code.

In general, discussion and cooperative learning on general topics is encouraged. Such discussion must be limited to general information such as lecture and text material or how to use software. Sharing your homework/project answers, or using another student's homework/project solutions, design, implementation, or other specific results is strictly prohibited and is an honor code violation. Copying computer files, designs, or solutions from any source is strictly prohibited and is an honor code violation. The midterm and final exams must be the work of the student. Consulting any other person except the instructor for this course about any aspect of an exam is strictly prohibited and is an honor code violation. Ask the instructor if you ever have a question about what constitutes acceptable or unacceptable sharing.




University, College, Department and Program Policies: A complete list of the policies associated with the conduct of this course is provided in our Canvas course site












(<https://canvas.vt.edu/courses/53299/pages/policies>).

Beliefs and Assumptions

As your instructor, as your guide through the course, I will do as much as I can to make this an interesting class, through the lectures, readings, homework problems, and projects. I believe that everyone in this program has the capability of doing well in the course, but I need your help! Especially because this is an online course, for example, where I cannot see your face during lecture to know if there are questions about what was just said, to get the most out of the course, I need you to be an active learner—keep up with the course schedule, ask me questions if you have them, and let me know if additional examples or resources are needed. For technical material such as is covered in this course, the best way to really understand the material is through hands-on problem solving and projects, and I can best help you if you let me know when you have questions. Also, though Virginia Tech utilizes the end-of-semester Student Perceptions of Teaching survey to officially collect your evaluation of the course, I welcome any such feedback from you during the semester as well. In any case, I look forward to seeing you in class!

Course Summary:

Date	Details	
Tue Jun 9, 2020	 <u>Homework 1</u> (https://canvas.vt.edu/courses/112443/assignments/875461)	due by 11:55pm
Tue Jun 16, 2020	 <u>Homework 2</u> (https://canvas.vt.edu/courses/112443/assignments/875462)	due by 11:59pm
Tue Jun 23, 2020	 <u>Homework 3</u> (https://canvas.vt.edu/courses/112443/assignments/875463)	due by 11:55pm

Date	Details	
Tue Jun 30, 2020	 Project 1 (https://canvas.vt.edu/courses/112443/assignments/875469)	due by 11:55pm
Tue Jul 7, 2020	 Homework 4 (https://canvas.vt.edu/courses/112443/assignments/875464)	due by 11:55pm
Sun Jul 12, 2020	 Midterm Exam (https://canvas.vt.edu/courses/112443/assignments/875460)	due by 11:59pm
Tue Jul 14, 2020	 Project 2 (https://canvas.vt.edu/courses/112443/assignments/875470)	due by 11:55pm
Tue Jul 21, 2020	 Homework 5 (https://canvas.vt.edu/courses/112443/assignments/875465)	due by 11:55pm
Tue Jul 28, 2020	 Project 3 (https://canvas.vt.edu/courses/112443/assignments/875471)	due by 11:55pm
Tue Aug 4, 2020	 Homework 6 (https://canvas.vt.edu/courses/112443/assignments/875466)	due by 11:55pm
Sun Aug 9, 2020	 Project 4 (https://canvas.vt.edu/courses/112443/assignments/875472)	due by 11:59pm
Tue Aug 11, 2020	 Homework 7 (https://canvas.vt.edu/courses/112443/assignments/875467)	due by 11:55pm
Fri Aug 14, 2020	 Final Exam (https://canvas.vt.edu/courses/112443/assignments/875459)	due by 11:59pm
	 Homework 8 (https://canvas.vt.edu/courses/112443/assignments/875468)	due by 11:59pm