



CSCI 4677/5677 - Internet of Things Fall 2020 Syllabus

Instructor(s)	Course details	Required Material	Schedule	Grading	Expectations	Other Policies
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Last updated: 07/20/2020

NOTE: Updates to this syllabus will be made as changes occur in University or Department policies, student needs, instructor needs, or available content.

Instructor(s):

Instructor: **David Tarnoff**

Office: Room 4-469, [Roy S. Nicks Hall](#)

Office Hours: Monday & Wednesday: 2:30 to 4:00 PM online via Zoom
Tuesday & Thursday: 10:00 to 11:30 AM online via Zoom
or by appointment
[Click here for latest schedule](#)

Phone: 423.439.6404 (Office/voice mail)

e-mail: tarnoff@etsu.edu*

Web page: This course uses [ETSU's D2L server](#) for online content.

*** All attempts will be made to answer emails within one business day after receipt. Email is not monitored between the hours of 6:00 PM and 8:00 AM nor is it monitored on weekends.**

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Course Details:

Course Number: CSCI 4677/5677

Course Title: Internet of Things

Catalog Description: Presents networking and security concepts related to Internet of Things(IoT), placing special emphasis on IoT hardware and data analytics.

Prerequisites: C- or higher in either CSCI 2210 - Data Structures or CSCI 2910 - Server-Side Web Programming and a C- or higher in CSCI 3400 - Networking Fundamentals

Credit: 3 credit hours

Outcomes: Internet of Things provides exposure to Computing students in a field with high contemporary interest. It's designed to allow students to apply programming and analytical skills taught in its prerequisite courses to the development of complex real-world systems using connected devices. Its incorporation into the curriculum adds a new area of opportunity to the undergraduate concentration in cybersecurity and, more broadly, to the Department; makes the curriculum more attractive to students; and provides more opportunities for employment by Department's professional partners and employers.

This course is designed to enable students to:

- Define and evaluate concepts, trends, and core hardware components of Internet of Things and embedded devices.
- Develop programs and systems that connect to Internet of Things cloud platforms.
- Employ design principles for Internet of Things platforms.
- Analyze advanced concepts of software and hardware architecture of the Internet of Things devices.
- Program state-of-the art Internet of Things devices.
- Evaluate fundamental security mechanisms within the Internet of Things realms.
- Assess current, cutting edge research in the cloud domain.

Course Delivery Method: Due to the ever-changing mandates resulting from the COVID-19 pandemic, the decision was made to change the course delivery method for this fall's sections of CSCI 4677/5677 to asynchronous online. While all material can be consumed asynchronously, students may decide to attend the streamed recording session synchronously and participate via online chat.

Although this course is classified as asynchronous, there are assigned dates before which the student must have completed a review of the content and associated assignments. The schedule section of this syllabus identifies the date on which the

content should be covered while the due dates for the assignments will typically be at 11:59 PM two days after that date.

The D2L site will be organized so that each date/topic is a module containing sub-modules for reading, video, assessments/quizzes, and discussion. The content in the reading and video sections will overlap, and the student is encouraged to use the media with which they are most comfortable. That said, there are a couple of topics that might not be covered as completely with one or more of the available media. There will be a note in the modules indicating when this is the case.

There will be an assessment associated with the material presented in each lecture. This will typically be a D2L quiz. **Each quiz will be due at 11:59 PM two days after the lecture where the material was presented.** The reason for this due date is to ensure that the students stay current on the material while also giving students an opportunity to ask questions to clarify problems found on the quiz.

Due to the absence of face-to-face meeting time, students may also submit questions via the D2L discussion forum. Each topic module will have a discussion forum for that topic where the students can post questions. Every attempt will be made to review these questions during the following lecture.

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Required Materials:

Every effort has been made to use on-line reference material for this course. The vast majority of the reading will come from two textbooks: one by Maneesh Rao and one by John Catsoulis. Other readings may be used to supplement the main texts, the links to which will be provided through the content portion of the course D2L site.

The text is available online through O'Reilly Media. Sherrod Library has an O'Reilly subscription, so access to these books is free. There is a mobile app available or you can use your ETSU login to access your personal account. By clicking on the link shown below for the textbook, you will be taken to the O'Reilly Media site. **Do not** click on the sign-up or free trial link. Select instead the sign in link. This will take you to a page where you can log in via your ETSU credentials. After entering your email address (and possibly hitting tab to move to the next text field) you will be presented with an SSO login screen where you can enter your ETSU password.

- Catsoulis, John (2005). Designing Embedded Hardware, 2nd Edition. Surrey, UK: O'Reilly Media, Inc., Retrieved July 17, 2020, from O'Reilly Media, Inc. <https://learning.oreilly.com/library/view/designing-embedded-hardware/0596007558/>).
- Rao, Maneesh (2018). Internet of Things with Raspberry Pi 3. Birmingham, UK: Packt Publishing, Retrieved July 17, 2020, from O'Reilly Media, Inc. (<https://learning.oreilly.com/library/view/internet-of-things/9781788627405/>).
- Tarnoff, David (N/A). Embedded System Design for CS Majors. ([Electronic copies will be made available through D2L](#)).

Students can also find more computer science research materials at Sherrod Library's Research Guide for Computer & Information Sciences.

Required ARM Processor Board (Raspberry Pi) - All laboratory exercises for the course will be performed on the ARM Cortex-A based Raspberry Pi single-board computer. Each student will need to purchase either the latest version of the Raspberry Pi 3 Model B+ or the slightly more expensive Raspberry Pi 4. At the time of this writing, **the Raspberry Pi 3 Model B+ is available by itself for around \$40 before shipping (an additional purchase of an SD card and a suitable power supply is required)**. It is suggested that each student purchases a "kit" such as those available from Canakit that includes items such as the power supply, SD card, housing, heatsinks, cabling, and so on. Purchasing instructions have been sent via email to all registered students. If you have not received instructions, please email the instructor for a copy. (Note that the Raspberry Pi Foundation recommends an SD card of at least 16 GB, but 32 GB are cheap enough that it is suggested to go with the larger size. The power supply must be capable of supplying 2.0A for the Raspberry Pi 3 and 3.0A for the Raspberry Pi 4.)

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Course outline:

The course outline is presented below. The instructor has the right to alter the outline at any time due to time constraints, unexpected scheduling conflicts, or overall benefit to class effectiveness. **Although this course is being delivered asynchronously, dates are included in the table to help the student keep track of when they are expected to have covered the material. This will be of particular importance when it comes to the course assessments.**

Week	Date	Lecture or Lab Topic	Reading
1	08/25	Expectations, Platform Intro. & Set-up	Rao - "Introduction to IoT" to "Setting up Raspberry Pi"
	08/27	Raspberry Pi Connectivity	Rao - "Connecting to the Internet" and "Setting up Headless Raspberry Pi"
2	09/01	Networking Fundamentals Review	(See D2L Content Page)
	09/03	JavaScript and Node.js Intro	Rao - "Let's Communicate" to

		"Advantages of Using Node.js for IoT"
3	09/08 Advanced Node.js Topics	(See D2L Content Page)
	09/10 HTTP Protocol	Rao - "HTTP" to "HTTP client"
4	09/15 MQTT Protocol	Rao - "MQTT" to "MQTT topics"
	09/17 The Mechanics of Sessions 1	Rao - "QoS Levels" to "Keep Alive Message"
5	09/22 MQTT Implementation of Sessions 2	Rao - "Persistent Sessions" to "MQTT Client"
	09/24 Electrical Principles 1	Catsoulis - Sect. 4.1-4.7
6	09/29 Passive Device Demonstration	(See D2L Content Page)
	10/01 Electrical Principles 2	Catsoulis - Sect. 4.8-4.15
7	10/06 Test 1 Review/Active Device Demonstration	(See D2L Content Page)
	10/08 Test 1	N/A
8	10/13 Connecting to the Electronics	(See D2L Content Page)
	10/15 Digital Motors	Tarnoff - Ch. 5 via D2L
9	10/20 Servo Demonstration	(See D2L Content Page)
	10/22 Board Level Communication (SPI & I2C)	SparkFun SPI and I2C Tutorials via D2L
10	10/27 Cloud Services	Rao - "Amazon Web Services" and "AWS S3"
	10/29 Intro to Big Data	(See D2L Content Page)
11	11/03 Data Acquisition (Audio)	(See D2L Content Page)
	11/05 Data Acquisition (Images/Video)	(See D2L Content Page)
12	11/10 Security in IoT	Rao - "Security in IoT" to "Device Firmware Upgrade"
	11/12 Secure Communication	Rao - "Secure Communication" to "Ignorance from Customers and Manufactures"
13	11/17 Project Work	N/A
	11/19 Project Work	N/A
14	11/24 Thanksgiving Break	N/A
	11/26 Thanksgiving Break	N/A
15	12/01 Project Presentations 1	N/A
	12/03 Test 2 Review/Project Presentations 2	N/A

Grading Policy:

Written Tests - There will be a midterm and a final exam given during the semester, each graded on a 100-point scale and carrying equal weight toward the calculation of the student's final grade. The tests will consist of a number of short and long answer questions along with some short coding problems. Although these exams will be online, each student must take the exam during the scheduled time and date. Additional details regarding each exam will be provided during the scheduled review days. The exams may include any material covered in lectures, assigned readings, or exercises even if the material was not covered directly in lecture. Both exams will be timed.

Laboratory Exercises - Approximately one laboratory exercise will be given each week to support the material covered in the week's lecture(s). Typically, each laboratory will involve the development of code to be run on the Raspberry Pi platform. Grades will be assigned representing how well each student achieved the laboratory's objectives.

Quizzes - In addition to the laboratory exercises, weekly quizzes will be given to support the material covered in the week's lecture(s). These quizzes will be conducted online and will typically be due at 11:59 PM on the Friday of the week when the material was presented.

Projects - Two projects will be assigned during the semester that will combine three or more of the laboratory concepts into a single-purpose IoT application. These projects are to be completed individually and submitted via the D2L dropbox. Since these projects will be more complex than the laboratory exercises, the student will want to begin work as soon as they are assigned.

Assessment Weighting - The table below shows the weights carried by each assignment toward calculating a student's final grade.

Assignment	Portion of final grade
Laboratories & quizzes	25 %
Midterm Exam	20 %
Final Exam	20 %
Midterm Project	15 %
Final Project	20 %
Total	100%

The table below presents the translation between a student's total score and his or her final grade.

Percent cutoff (Minimum score to receive grade)	Grade
93	A
90	A-
87	B+
83	B
80	B-
77	C+
73	C
70	C-
67	D+
60	D
0 to less than 60	F

Posting of grades: As soon as grades are available, they will be posted to the grades section of the course's [D2L site](#). Due to the un-secured nature of email, this is the only method outside of work returned directly to the student where grades will be discussed or posted.

Make-up Tests: In some cases, a make-up test can be given for authorized university activities **only** if a student presents suitable documentation explaining the absence to the instructor **prior** to the scheduled test time. The instructor reserves the right to disapprove any explanations for absences presented without prior notice and not provide the opportunity for a make-up test. **Students knowing they will be absent from an announced test because of personal or business reasons are required to inform the instructor before the absence.** A make-up test may be given early in some cases.

Late Penalties: Due to the University imposed modifications to the course delivery method, no allowances will be made for work submitted late without suitable documentation explaining the absence to the instructor.

Expectations, Attendance, and Participation:

Both students and instructors have expectations of one another, many of which are mutual. Students should expect the instructor to be in class on time, to be prepared, to be attentive to students, to be available to provide help related to the course, and to make a genuine effort to help students achieve the course objectives. On those rare occasions when the instructor must miss class, students should expect suitable arrangements for the class to continue in the instructor's absence. Students should expect the instructor to devote considerable time and effort to the course.

The instructor has similar expectations of students: that students come to class on time, are prepared, are attentive and participate in class, complete class assignments and submit them on time, and make a genuine effort to meet the course objectives. The instructor expects students to devote considerable time and effort to the course.

Student Responsibility for Work

Regardless of whether a student is able to come to class or not, every student is still responsible for material, assignments, and anything else that occurs in class. If a student must miss class, that student is responsible for finding out what was missed, making sure that any work due that day gets to the instructor, and acquiring any assignments or materials handed out during the absence so that he or she can prepare for the next class. ***This is a 3 credit-hour course and each student should be prepared to spend a minimum of 3 to 4 hours outside of class for each hour in-class, a requirement that is especially vital in this time of mixed-delivery.***

Attendance and participation is important; students with poor attendance generally do poorly. Missing material from one class makes it difficult to understand new material and, once behind, it is difficult to catch up. Students are encouraged to ask appropriate questions and to participate in class discussions and activities. Students may learn as much from one another as from the instructor. If anyone is confused about some point, chances are that others are also confused and will appreciate that someone has asked for clarification.

Any asynchronous content intended for remote access should be reviewed in a timely manner. The tendency to, "get around to it eventually," may result in the student getting too far behind to catch up.

Instructor Communication Outside Office Hours

In this age of instant communication, it is common to think that everyone is accessible for 24/7 feedback. Please understand that the instructor has other obligations and may not be able to respond immediately to questions submitted by e-mail or voice mail. Be sure to take advantage of other resources to answer your questions if the instructor has not responded to your message in a timely manner. Other resources include the reading, podcasts, and videos, and when issues of academic integrity are not in question, other students. Please do not take this as an attempt to discourage questions, only to let you understand that there will be times when the instructor is not available to immediately answer your questions.

Health and Safety

Although this class is designated as an online course, there may be points at which face-to-face meetings may occur. If this happens, the face-to-face activities are to adhere to all guidelines specified by the University. This includes the mandatory and proper use of face masks and observance of physical distancing. The classroom and lab environments are conducive to the transmission of disease. Please be considerate of our class if you are sick.

Please wear a mask or other appropriate face covering to class. Wearing a mask that covers your nose and mouth communicates the care and respect you have for yourself, the care and respect you have for those you live with, and the care and respect you have for other members of this classroom community. The best evidence we have, from public health professionals, is that wearing masks is one of the best ways to protect against the spread of Covid-19 and other airborne illnesses. For the safety of your classmates, if you forget your mask, a few masks will be made available each day to distribute. If you choose not to wear a mask, you will not be able to attend class face to face.

Students and employee who need to request accommodations related to the wearing of a facial covering/mask should contact the Office of Disability Services and provide related documentation supporting the request. Some examples of accommodations could include taking the online version of a course, a faculty member wearing a clear facial covering/mask that permits lip reading or wearing a face shield instead of a mask. Disability Services may be contacted at (423) 439-8346 or email Director Mary Little at littleme@etsu.edu.

If you have been diagnosed with COVID-19 or have symptoms consistent with COVID-19, do not come to any face-to-face activities. Symptoms of COVID-19 include (Source: <https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>):

- Fever or chills
- Cough
- Shortness of breath or difficulty breathing
- Fatigue
- Muscle or body aches

- Headache
- New loss of taste or smell
- Sore throat
- Congestion or runny nose
- Nausea or vomiting
- Diarrhea

Each student is responsible for all academic work missed as a result of their absence. Contact the instructor as soon as you know that you will not be attending class to make arrangements to access course material and complete your assignments.

Academic Integrity:

Without exception, all work for this class is to be done on an individual basis. - Student-teacher relationships are built on trust. For example, students must trust that teachers have made responsible decisions about the structure and content of the course, and teachers must trust that work submitted by a student was indeed done by the student. Acts which violate this trust undermine the educational process and are inconsistent with our very reason for being at ETSU.

You are encouraged to discuss the material and issues addressed in the course with members of the class and others. Helping one another understand the process for problem solving is permitted as long as submitted work is done as an individual attempt. Everyone must do his/her own work. Completing an assignment "by committee" and submitting it as an individual work is academic misconduct unless the assignment has been clearly designated as a team assignment. **Your name on submitted work is an affirmation that the work is yours.**

The following is taken from section 5.7 "Academic Misconduct" of the East Tennessee State University Faculty Handbook, June 1, 2001:

"Academic misconduct will be subject to disciplinary action. Any act of dishonesty in academic work constitutes academic misconduct. This includes plagiarism, the changing of falsifying of any academic documents or materials, cheating, and the giving or receiving of unauthorized aid in tests, examinations, or other assigned school work. Penalties for academic misconduct will vary with the seriousness of the offense and may include, but are not limited to: a grade of 'F' on the work in question, a grade of 'F' of the course, reprimand, probation, suspension, and expulsion. For a second academic offense the penalty is permanent expulsion.

"Plagiarism is defined as follows by Black, Henry Campbell, Black's Law Dictionary, West Publishing Company, St. Paul, Minnesota, 1968 (p. 1308): 'The act of appropriating the literary composition of another, or parts or passages of his writings, or the ideas or language of the same, and passing them off as the product of one's own mind.'

"Moreover, 'To be liable for plagiarism it is not necessarily to exactly duplicate another's literary work it being sufficient if unfair use of such work is made by lifting of substantial portion thereof, but even an exact counterpart of another's work does not constitute 'plagiarism' if such counterpart was arrived at independently' (O'Rourke vs. RKO Radio Pictures, D. C., Mass., 44F. Supp. 480, 482, 483)."

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Special Accommodations - Students with needs for note taking or test taking accommodations should make arrangements with the instructor during the first week of the term.

Laptop Policy - The use of laptops or PDAs for the purpose of note taking or viewing the online course reading is permitted. **All other uses are prohibited.** Any student found to violate this policy will be asked to discontinue use of the device for the remainder of the class period. A second offense will result in the removal of the student's laptop privileges for the remainder of the semester.

Snow/Ice - Classes are seldom cancelled; use your better judgement if main roads are snow-covered or icy. Please listen to the radio (WETS) or visit the [University's Alert Page](#) if there is any doubt about early morning classes being cancelled or delayed.

The following is an excerpt from the University Inclement weather policy as it relates to delayed openings:

"Students are expected to report to their regularly scheduled class only if there are 30 or more minutes remaining in the session. For example, if a delayed opening is set for 10 a.m. students who have classes from 9:45 a.m. to 11:05 a.m. should report to that class at 10 a.m. Students who have classes from 9:20 a.m. to 10:15 a.m. should not report to class. In a delayed opening, all classes scheduled prior to the set time of opening and those that have less than 30 minutes remaining after the set opening time are cancelled for the day."

The policy goes on to state what the student's responsibility is if they miss class because of severe weather.

"Students will be responsible for any academic work they miss due to absences caused by severe weather conditions. It is the individual student's responsibility to take the initiative to make up any missed work, and it is the instructor's responsibility to provide a reasonable opportunity for students to complete assignments or exams missed due to such absences. Faculty members have discretion in determining whether an additional session will be added for the class or if additional work is assigned due to the closure or delayed opening."

The inclement weather policy may be accessed at http://www.etsu.edu/safety/campus_emergency/policy.aspx.

Use of Tobacco Products: - The use of tobacco products of any type is prohibited inside all ETSU campus buildings. ETSU is a non-smoking campus. Smoking is permitted on campus only in private vehicles.

Please make sure to see the [syllabus attachment](#) provided by the [Office of the Registrar](#) regarding key dates and other information.

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Use of this document is restricted to students enrolled in CSCI 4677/5677 at East Tennessee State University