

## Course Outline

### 1. COURSE INFORMATION

<b>Session Offered</b>	Winter 2022	
<b>Course Name</b>	IoT Devices and Networks	
<b>Course Code</b>	SMRTTECH 4ID3	
<b>Date(s) and Time(s) of lectures</b>	Mondays 11:30 AM – 1:20 PM (Lecture) Thursdays 9:30 AM – 10:20 PM (Lecture) Fridays 3:30 PM – 6:30 PM (Laboratory)	
<b>Program Name</b>	Engineering Bach. Technology - Automation Eng Tech CO-OP	
<b>Calendar Description</b>	This course teaches how the Internet of Things IoT works. Students learn about IoT networks and how things connect to networks, including whether the connection and processing is local (fog computing), is on the network edge (edge computing), or is remote (cloud computing). In addition, students learn IoT data networks, connection types, layer models and IoT network protocols and standards.	
<b>Instructor(s)</b>	Dr. Marjan Alavi, P.Eng	E-Mail: <a href="mailto:alavis2@mcmaster.ca">alavis2@mcmaster.ca</a> Office Hours & Location: online Thursday 10:30 AM – 11:30 AM Mondays 1:30 PM – 2:30 PM

### 2. COURSE SPECIFICS

<b>Course Description</b>	This course teaches the fundamentals of IoT, design and implementation of hardware and software for IoT application. Topics covered include: <ul style="list-style-type: none"> <li>• Introduction to the IoT term, and how IoT Networks are designed and constructed.</li> <li>• IoT software design and implementation using open-source technology.</li> <li>• IoT network architecture and design, and IoT functional stack</li> <li>• IoT networking layers and standard protocols</li> <li>• Smart object connection technologies, standards, and power considerations</li> <li>• IPv6 Routing Protocol for Low-Power and Lossy Networks (RPL)</li> <li>• Common application protocols such as MQTT and web-based protocols.</li> <li>• Introduction to machine learning and data analytics for IoT</li> <li>• Data analytics in Python</li> <li>• IoT application in different sections</li> </ul>		
<b>Instruction Type</b>	<b>Code</b>	<b>Type</b>	<b>Hours per term</b>
	C	Classroom instruction	37
	L	Laboratory, workshop or fieldwork	33
	T	Tutorial	
	DE	Distance education	
	<b>Total Hours</b>		70
<b>Resources</b>	<b>ISBN</b>	<b>Textbook Title &amp; Edition</b>	<b>Author &amp; Publisher</b>
	ISBN-13: 9781587144561	IoT Fundamentals: Networking Technologies, Protocols,	David Hanes, Gonzalo Salgueiro, Patrick

		and Use Cases for the Internet of Things 1st edition	Grossetete, Robert Barton, Jerome Henry
	<b>Other Supplies</b>	<b>Source</b>	
	Online resources	Provided in the class, on Avenue, and Echo360 as required	
<b>Prerequisite(s)</b>	SMRTTECH 3CC3 and registration in level IV of Automation Engineering Technology and permission from the Department		
<b>Corequisite(s)</b>	SMRTTECH 4ES3		
<b>Antirequisite(s)</b>			
<b>Course Specific Policies</b>	<p>Absence from a test without an approved MSAF will result in a grade of zero for the test. If an approved MSAF is submitted, the weight of the missed test will be added to the final exam's weight. In case of multiple missed tests with approved MSAFs, the opportunity to write missed test(s) at an alternate date may be offered, at the discretion of the instructor.</p> <p>Quizzes:</p> <p>The quizzes will be on-line through Echo360 or Avenue. Absence from any quiz without an approved MSAF will result to a grade of zero for that quiz. A submitted MSAF for an on-line quiz will be accommodated by extending the submission window for that quiz.</p> <p>Lab Sessions:</p> <p>Electronic Lab safety rules must be followed in the lab.</p> <p>Absence from a lab without an approved MSAF form will result in a grade of zero for the lab.</p> <p>Students may have to complete a pre-lab quiz prior to attending certain labs.</p> <p>Details for number of labs and lab reports will be outlined on the avenue.</p>		
<b>Departmental Policies</b>	<p>Students must maintain a GPA of 3.5/12 to continue in the program.</p> <p>In order to achieve the required learning objectives, on average, B.Tech. students can expect to do at least 3 hours of "out-of-class" work for every scheduled hour in class. "Out-of-class" work includes reading, research, assignments and preparation for tests and examinations.</p> <p>Where group work is indicated in the course outline, such collaborative work is mandatory.</p> <p>The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception.</p> <p>Announcements made in class or placed on Avenue are considered to have been communicated to all students including those individuals that are not in class.</p> <p>Instructor has the right to submit work to software to identify plagiarism.</p>		
<b>3. SUB TOPIC(S)</b>			
Week 1 (11 Jan 2021)	IoT Network Architecture and Design Lab#1		
Week 2 (18 Jan 2021)	Internet Protocol Lab#2		

Week 3 (25 Jan 2021)	MQTT for IoT Communication Lab#3	
Week 4 (1 Feb 2021)	IoT Impact and challenges Lab#4	
Week 5 (8 Feb 2021)	Introduction to Python programming Lab#5	
Midterm Recess		
Midterm Recess		
Week 6 (22 Feb 2021)	Wireless communication Lab#6	
Week 7 (1 Mar 2021)	Smart Objects Lab#7	
Week 8 (8 Mar 2021)	Constrained Devices Lab #8	
Week 9 (15 Mar 2021)	Filtering Lab # 9	
Week 10 (22 Mar 2021)	Data Analytics Lab # 10	
Week 11 (29 Mar 2021)	Micro-Electro-Mechanical Systems (MEMS)	
Week 12 (5 Apr 2021)	IoT in Industry Lab # 11	
Week 13 (12 Apr 2021)	Final Review	
Midterm Recess: Monday, February 15 to Sunday, February 21 Classes end: Wednesday, April 14 Final Examination Period: Thursday, April 15 to Friday, April 30 All examinations MUST be written during the scheduled examination period.		
<b>List of experiments</b>		
Lab 1	Getting Started with Node-Red	
Lab 2	Packet Capture by Wireshark	
Lab 3	Hive MQTT and MQTT Box	
Lab 4	Smart Energy Monitoring	
Lab 5	Getting Started with Raspberry Pi	
Lab 6	Twython SDK	
Lab 7	Serial Communication with Arduino MKR1000	
Lab 8	Analog sensor interfacing and calibration	
Lab 9	Wifi communication and cloud connection	
Lab 10	Final Project Specifications and component selection	
No-class	Good Friday	
Lab 11	Final Project Presentation	
Note that this structure represents a plan and is subject to adjustment term by term. The instructor and the University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes.		

4. ASSESSMENT OF LEARNING *including dates*	Weight
Quizzes (In weekly lecture classes)	10%
Mid-term test	25%
Labs (Weekly)	15%
Project	
Part #1	3%
Part#2	12%
Final examination (tests cumulative knowledge)	35%
<b>TOTAL</b>	<b>100%</b>

Percentage grades will be converted to letter grades and grade points per the University calendar.

#### 5. LEARNING OUTCOMES

1. Define IoT, describe relevant technological and market trends, benefits, and drawbacks
2. Explain hardware and software limitations of IoT Devices.
3. Select appropriate hardware components and integrated circuits for IoT applications.
4. Design hardware and software for a given IoT application.
5. Explain standard Networking protocols for IoT applications.
6. Identify Network components and their functions.
7. Explain how internet works.
8. Design, implement, and troubleshoot an IoT project.

#### 6. COURSE OUTLINE – APPROVED ADVISORY STATEMENTS

##### ANTI-DISCRIMINATION

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.

[http://www.mcmaster.ca/policy/General/HR/Discrimination\\_Harassment\\_Sexual\\_Harassment-Prevention&Response.pdf](http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf)

##### ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. It is your responsibility to understand what constitutes academic dishonesty.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>

The following illustrates only three forms of academic dishonesty: The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

##### AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to [www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity).

### **COURSES WITH AN ON-LINE ELEMENT**

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

### **ONLINE PROCTORING**

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

### **COMMUNICATIONS**

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their @mcmaster.ca alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

### **CONDUCT EXPECTATIONS**

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

#### **ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES**

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

#### **REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK**

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

#### **ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)**

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests. <http://www.mcmaster.ca/policy/Students-AcademicStudies/Studentcode.pdf>

#### **COPYRIGHT AND RECORDING**

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

#### **EXTREME CIRCUMSTANCES**

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.