ENGINEERING
McMaster-Mohawk
Bachelor of Technology
Partnership

McMaster University

Course Outline

1. COURSE INFORMATION

Session Offered	Fall 2021	
Course Name	Cloud Computing and Internet of Things	
Course Code	SMRTTECH 3CC3	
Date(s) and Time(s) of lectures	Wednesday (2:30PM - 4:20PM) & Friday (9:30AM - 10:20AM) – Online lectures	
Program Name	Automation Engineering Technology	
Calendar Description	This course covers advanced sensor and actuator technology, robotics and vision systems, selection and integration of components for autonomous or collaborative smart systems, as well as component that enable data access of smart systems using IoT communication protocols, internet technologies, network security, and cloud computing.	
Instructor(s)	Dr. Mostafa Soliman (C01) Dr. Ahmed Fakhr (L01-L03) Neethila Poddar (L04-L06)	E-Mail: solimm12@mcmaster.ca Office Hours: Wednesdays & Fridays from 4:30PM to 5:30pm, and by appointment Location: Online E-mail: fakhrad@mcmaster.ca E-mail: poddarn@mcmaster.ca

2. COURSE SPECIFICS

Course Description

Instruction Type

Code	Type	Hours per term
C	Classroom instruction	38
L	Laboratory, workshop or fieldwork	33
T	Tutorial	
DE	Distance education	
	Total Hours	71

Resources

ISBN	Textbook Title & Edition	Author & Publisher
ISBN: 9780073380230 (optional)	Introduction to Mechatronics and Measurement Systems, 4th edition	*David G. Alciatore* *Pub: McGraw-Hill*
ISBN: 9780750658058 (optional)	Hand-son Industrial Internet Of Things	*Veneri & Capasso* *Pub: Packt Publishing*

Other Supplies	Source
Lab kit	provided by the school

Prerequisite(s)	ENGTECH 1PR3, PROCTECH 2EE3, 2IC3 and registration in level III or above of Automation Engineering Technology

Corequisite(s)	
Antirequisite(s)	
Course Specific Policies	**Lab attendance is mandatory to receive marks for the lab reports.** All the Labs will be performed individually by every student. During the lab time, groups consisting of two students will use (virtual) breakout rooms to collaborate and confirm their results. Any required video submission for the labs will be submitted individually. Lab reports can be submitted per group. Students will have one week after a lab experiment to submit their lab reports. The lab reports must be submitted within the first 15 minutes of the start of the subsequent lab session. The lab report may be submitted late at a penalty of 10% per day up to a maximum of 70% off, or seven days late. If a report is submitted after the seven-day late period, the report will receive a mark of zero. Students that miss a lab will require an official exemption, i.e. MSAF, to avoid receiving a mark of zero. Students will write 5 quizzes, where the best 4 out of 5 will be counted toward their final mark.
Departmental Policies	Students must maintain a GPA of 3.5/12 to continue in the program. 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. Where group work is indicated in the course outline, such collaborative work is mandatory. 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. 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. Instructor has the right to submit work to software to identify plagiarism.

3. SUB TOPIC(S)		
Week 1	**Introduction to Internet of Things and Cloud Computing** Defining IoT and IIoT, IoT applications	
Week 2	**Digital Systems, Decimal, Binary, and Hexadecimal Number Systems:** Number conversion to binary, decimal, Hex, Digital logic, 2's Complement, introduction to Arduino	
Week 3	**Introduction to Sensors:**	

	Sensor classification, optical encoders, temperature, strain gauges, etc...	
Week 4	**More on Sensors:** Force, Pressure, acceleration sensors	
Week 5	**Introduction to Actuators:** DC motors, Stepper motors, solenoids, valves	
Week 6	**More on Actuators:** Servomotors, AC Motors	
Week 7	**Actuator Interfacing and Control** Controlling DC motors, stepper motors, and solenoids	
Week 8	**Introduction to Networks** fundamental concepts of serial communication, UART, I2C	
Week 9	**IoT Protocols** TCP/IP networking, MQTT	
Week 10	**Cloud Computing and IoT** Cloud services and deployment models, typical IoT platform capabilities	
Week 11	**Introduction to Data Analytics and Machine Learning in the Cloud** **Signal Conversion I:** ADC, DAC, and quantization	
Week 12	**Signal Conversion II:** Sampling, Nyquist theory, filtering	
Week 13	**Case Studies**	

Classes end: Wednesday, December 8th, 2021
Final Examination Period: Thursday, December 9 to Wednesday, December 22
All examinations MUST be written during the scheduled examination period.

List of experiments	
Lab 1	Introduction to Sensors, Actuators and Arduino
Lab 2	Introduction to LabVIEW
Lab 3	Temperature Sensor
Lab 4	Tilt Sensor
Lab 5	Servo Motor
Lab 6	Introduction to Stepper Motors
Lab 7	Connecting to the Cloud Using a Public Broker
Lab 8	Soil Moisture Sensing and IBM Watson IoT Platform
Lab 9	Design Project
Lab 10	Design Project
Lab 11	Design Project Demo

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
Class Participation & Active Learning	5%
Quizzes (best 4 out of 5)	10%
Labs	12.5%
Lab Project	12.5%
Mid-term tests (worth 15% each)	30%
Final examination (tests cumulative knowledge)	30%
TOTAL	**100%**

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

5. LEARNING OUTCOMES

1. Use binary, hexadecimal, and octal numbering systems
2. Explain the difference between analog and digital signals, sampling theory, Analog to digital signal conversion
3. Utilize sensors, actuators, DAQ cards, and microcontrollers
4. Define cloud computing and explain its essential characteristics, history, & emerging trends
5. Explain different IoT communication protocols and internet technologies
6. Stream sensor data to the Cloud and perform basic data analytics
7. Plan and complete an IoT Project from the early planning stage to its final presentation.

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

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.

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 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.