

MATERIALS 4Q03

Materials for Sensors in Big Data and AI Systems

Instructor: Prof. Gu Xu, JHE 357, xugu@mcmaster.ca, x 27341

Course Schedule: Fridays, 14:30-17:20 pm, Microsoft Teams

Teaching Assistant:

Course Description:

This course will introduce students to the various concepts of Sensors and sensing materials for big data and artificial intelligence systems. And will discuss the theory, design and fabrication of chemical, thermal, electrical, magnetic and optical sensors.

Course Outcomes:

At the end of the course, students are expected to show the ability to:

- Understand the fundamentals of various sensor types for physical and chemical data.
- Understand the fundamentals of several broad classes of sensing materials.
- Understand the applications of several broad classes of sensor devices.
- Analyse the literature resources to assess wide range of information related to big data sensors and sensing materials.
- Communicate effectively a literature review on big data sensing through a presentation to the class, complete with Q&A.

MATLS 4Q03 is an important part of your training as an engineer. In particular the course will allow you to:

Gain Specialized Engineering Knowledge including:

- (a) How sensing systems work.
- (b) The main structure of advanced sensing materials and devices.
- (c) State-of-the-art applications of these materials and devices

Evaluation:

- 1) Mid-term (30%): This 1 hr exam will take place in mid-October, covering the first half of the lectures.
- 2) Final Examination (35%): 1hr exam: This exam will focus on contents described and taught during the 2nd half of the lecture part.
- 3) Student Presentations (35%): Students will be required to deliver a 15 minute presentation based on a topic to be chosen. A student will present a 15 minute lecture, to be followed by a class-wide 10 minute Q&A session.

Evaluation hinges on presentation completeness, with an introduction, main content, and application section. Presenters will also be evaluated on presentation style, with a focus on clarity, ease of understanding, and audience engagement.

Depending on the number of student enrolled, we will have teams of two people per presentation or individual presentations delivered. The presenters will share their slides for review one week in advance in order to ensure high quality.

All of the presentation slides will be shared on Avenue after the presentations.

Approximate timeline for the course:

- 1) Introduction to big data sensing, main types of physical and chemical sensors
- 2) Semiconductors and devices
- 3) Optical materials, devices, spectroscopy
- 4) Magnetic materials etc. and devices
- 5) Electrochemical cells and sensors
- 6) Bio-electronic materials and sensors
- 7) Student presentations

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:

- 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 or 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.

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.

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.