Instructor: Professor Belaid Aouni
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Office:

Teaching Assistant (TA):
Teaching Assistant Email:
Teaching Assistant Office Hours: To be announced. By appointment only.

Delivery mode: In-class (note: one or two classes might be offered on Zoom)
Course Meeting: Monday, 2:35pm – 5:25pm

Pre-requisites: Third year standing, and BUSI 2301 (with a grade of C or higher)
Precludes additional credit for BUSI 4431 (no longer offered)

Course Calendar description: This course shows how Industry 4.0 employs the Internet of Things (IoT) and Al technologies to achieve self-thinking supply chains. It demonstrates the use of Industry 4.0 in the transformation to smart industries. Lectures, demonstrations, and hands-on exercises allow students to design, deploy and manage custom IoT solutions. Precludes additional credit for BUSI 4431 (no longer offered). Prerequisite(s): third year standing and BUSI 2301(with a grade of C or higher). Lecture three hours a week and lab one hour a week.

Course Overview: Industry 4.0, known as the Fourth Industrial Revolution, is a multi-trillion-dollar digital transformation of the economy. Its vision is to create self-thinking supply chains by connecting every "thing" including products, services, and operations to the internet using sensor technologies in what is known as the IoT. This enables real-time collection, communication, and analysis of operational data. Leveraging data science and artificial intelligence on this real-time data in turn enables autonomous decision making and ultimately what is called self-thinking supply chains. This course will show how Industry 4.0 employs the IoT and Al technologies to achieve this vision.

Required Materials

Textbook: Misra, S., Roy, C., Mukherjee, A. "Introduction to Industrial Internet of Things and Industry 4.0," CRC Press, Taylor and Francis, 2021. e-Book available for Carleton University students for free through the library.

Cases: cases will be made available by the library
- Bossard AG: Enabling Industry 4.0 Logistics, worldwide. Harvard Publishing.
- Coda Coffee and Bext360 Supply Chain: Machine Vision, AI, IoT, and Blockchain. Harvard Publishing

Presentation Slides: Where applicable, each week before class, the instructor will post a slides deck on BrightSpace to facilitate access to the week's topic. These slides will determine the parts in a given chapter that are included in the course coverage.

Course Evaluation

Grade Distribution

In-class presentations (3 presentations)	30%
Term paper	50%
Term paper presentation	10%
Attendance and Participation	10%

In-Class presentations
These three presentations aim at incrementally developing the term project following the rubrics that will be shared on Brightspace. Each group must submit their presentation slides in PowerPoint no later than 11:59 pm the night before the presentation as indicated in the tentative schedule.

Term paper
Students will work in randomly formed groups to identify and describe a sharply defined problem and craft an Industry 4.0 solution to tackle that problem. A group will detail their project in a term paper of 20 pages double space to address the rubrics that will be shared on Brightspace.

Term paper presentation
Each student group will present their term paper at the end of the term in a 30-min presentation followed by a 10-min Q&A. The rubrics will be made available on Brightspace. Each student in a given group is expected to have full knowledge of all parts of the project and will be evaluated accordingly. Each group must submit their term paper in MS Word and their presentation slides in PowerPoint no later than 11:59pm the night before the presentation as indicated in the tentative schedule.

Attendance and Participation
This course is highly interactive and requires students' engagement as a necessary requirement for learning. Accordingly, attendance and participation in class activity are highly emphasized and carry significant weight in course evaluation. Attendance will be taken electronically using Poll Everywhere supported by Carleton's Educational Development

Center. You need to register on Poll Everywhere using your email account (get in touch with EDC for any technical problems). A connected device such as a smartphone, tablet, or laptop is required in class to register attendance. In order to get the full participation mark, a student should not miss more than two classes and electronically answer the Poll Everywhere attendance question in class. Missing more than two classes is highly discouraged and will result in 50% reduction in the overall attendance grade.

Communication

Students should use their "first.last@carleton.ca" email account and not any other email accounts to communicate with the instructor.

Tentative Schedule

Wk	Date	Topics	Delivery Mode	Resources	Assignments
		Industry 4.0 Technologies			
1	Sep. 09	**Introduction to Internet of Things and Industry 4.0** Introduces IoT/Industry 4.0 history and forecasted trends, technology infrastructure, and solution architecture. Also, introduces the applications of IoT/Industry 4.0 in smart supply chain to generate value to stakeholders.	In-Class	Ch.01 Text #1 Ch.02 Text #1 Ch.03 Text #1 Ch.04 Text #1	
2	Sep. 16	**Data Science and Analytics for Industry 4.0** Introduces students to the analytics capabilities that can be used to extract insights from data for Decision-Making.	In-Class	Ch.12 Text #1	
3	Sep 23	**Industry 4.0 Cloud Services** **Building Practical Industry 4.0 Solutions on the Cloud** Overviews IoT cloud services and Platform capabilities. In-class hands-on experience building IoT solution using students' cell phones as beacons.	In-Class	Ch.06 Text #1 Ch.07 Text #1	
4	Sep 30	**Students Presentations**			In-Class Assignment #1
		Industry 4.0 Applications			
5	Oct. 07	**Industry 4.0 for Healthcare Industry** Overview of the applications of Industry 4.0 in healthcare. Strategies for sensor deployment and data collection in smart healthcare applications.	In-Class	Ch.14 Text #1	
6	Oct. 14	**October 14 is thanksgiving holiday. No class.**			
7	Oct. 21	**Fall Break. No class.**			
8	Oct. 28	**Industry 4.0 for Inventory Management and Quality Control** Overview of the applications of Industry 4.0 in logistics, inventory management, and quality control. Strategies for sensor deployment and data collection in smart logistics applications.	In-Class	Ch.15 Text #1	In-Class Assignment #2 Students Presentations
9	Nov. 4	**Industry 4.0 for Plant Safety and Security** Overview of the applications of IoT in safety and security. Strategies for sensor deployment and data collection in smart production applications.	In-Class	Ch.16 Text #1	

		The Business of Industry 4.0			
10	Nov. 11	**Analytics and Insights in Smart Supply Chains** Hands-on analysis of industry 4.0 datasets. Driving business insights using artificial intelligence methods. Exploring potential opportunities for turning real-time sensing and Sense-Making to self-thinking supply chains.	In-Class	Ch.13 Text #1	
11	Nov. 18	**Industry 4.0 Business Model** Explore the components of Industry 4.0 business models. Stakeholders. Value proposition. Revenue generation models and strategies.	In-Class	Ch. 05 Text #1	In-Class Assignment #3 Student Presentations
12	Nov. 25	**Cases:** - Bossard AG: Enabling Industry 4.0 Logistics, worldwide. Harvard Publishing. - Coda Coffee and Bext360 Supply Chain: Machine Vision, AI, IoT, and Blockchain. Harvard Publishing	In-Class	Harvard Case	
		Term Project Presentations			
13	Dec. 2 Dec. 6	**Term Paper Presentations**			**Term Paper Due**

ADDITIONAL INFORMATION

Course Sharing Websites
Materials created for this course (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).

Required calculator in BUSI course examinations
If you are purchasing a calculator, we recommend any one of the following options: Texas Instruments BA II Plus (including Pro Model), Hewlett Packard HP 12C (including Platinum model), Staples Financial Calculator, Sharp EL-738C & Hewlett Packard HP 10bII

Group work
The Sprott School of Business encourages group assignments in the school for several reasons. They provide you with opportunities to develop and enhance interpersonal, communication, leadership, follower-ship and other group skills. Group assignments are also good for learning integrative skills for putting together a complex task. Your professor may assign one or more group tasks/assignments/projects in this course. Before embarking on a specific problem as a group, it is your responsibility to ensure that the problem is meant to be a group assignment and not an individual one.

In accordance with the Carleton University Undergraduate Calendar (p 34), the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90-100	B+ = 77-79	C+ = 67-69	D+ = 57-59
A = 85-89	B = 73-76	C = 63-66	D = 53-56

A - = 80-84   B - = 70-72   C - = 60-62   D - = 50-52
F   = Below 50

Grades entered by Registrar:
WDN = Withdrawn from the course
DEF = Deferred

Academic Regulations
University rules regarding registration, withdrawal, appealing marks, and most anything else you might need to know can be found on the university's website, here: http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/

Requests for Academic Accommodation
You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation
Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: **carleton.ca/equity/wp-content/uploads/Student-Guide-to-AcademicAccommodation.pdf**

Religious obligation
Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: **carleton.ca/equity/wp-content/uploads/Student-Guide-to-AcademicAccommodation.pdf**

Academic Accommodations for Students with Disabilities
If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-5206608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. **carleton.ca/pmc**

Survivors of Sexual Violence
As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and its survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to

obtain information about sexual violence and/or support, visit: **carleton.ca/sexualviolence-support**

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. **https://carleton.ca/senate/wp-content/uploads/Accommodation-for-StudentActivities-1.pdf**

For more information on academic accommodation, please contact the departmental administrator or visit: **students.carleton.ca/course-outline**

Academic Integrity

Violations of academic integrity are a serious academic offence. Violations of academic integrity – presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student – weaken the quality of the degree and will not be tolerated. Penalties may include; a grade of Failure on the submitted work and/or course; academic probation; a refusal of permission to continue or to register in a specific degree program; suspension from fulltime studies; suspension from all studies at Carleton; expulsion from Carleton, amongst others. Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy which is available, along with resources for compliance at: https://carleton.ca/registrar/academic-integrity/.

Sprott Student Services

The Sprott student services office, located in 710 Dunton Tower, offers academic advising, study skills advising, and overall academic success support. If you are having a difficult time with this course or others, or just need some guidance on how to successfully complete your Sprott degree, please drop in any weekday between 8:30am and 4:30pm. Our advisors are happy to discuss grades, course selection, tutoring, concentrations, and will ensure that you get connected with the resources you need to succeed! http://sprott.carleton.ca/students/undergraduate/learning-support/

Centre for Student Academic Support

The Centre for Student Academic Support (CSAS) is a centralized collection of learning support services designed to help students achieve their goals and improve their learning both inside and outside the classroom. CSAS offers academic assistance with course content, academic writing and skills development. Visit CSAS on the 4th floor of MacOdrum Library or online at: carleton.ca/csas.

Important Information:
- Students must always retain a hard copy of all work that is submitted.
- All final grades are subject to the Dean's approval.
- For us to respond to your emails, we need to see your full name, CU ID, and the email must be written from your valid CARLETON address. Therefore, in order to respond to your inquiries, please send all email from your Carleton CMail account. If you do not have or have yet to activate this account, you may wish to do so by visiting https://carleton.ca/its/get-started/new-students-2/