

York University SDG Course Inventory

SDG 9 – Industry, Innovation and Infrastructure

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



SDG 9 - Industry, Innovation and Infrastructure seeks the development and construction of sustainable infrastructure. To address global challenges, sustainable infrastructure must be laid that makes all economic and social systems more equitable, efficient, and sustainable. Specific targets for SDG 9 include supporting the least developed countries, investing in advanced technologies, lowering carbon emissions, and increasing global mobile broadband access.

Being one of the broadest SDGs, many York courses spanning every faculty are relevant to SDG 9. Students can information technology, mechanical engineering, management, and marketing courses on topics spanning programming, entrepreneurship, data analytics, market research, digital media, architecture, and manufacturing.

[Click Here](#) to learn more about York’s initiatives towards accomplishing SDG 9

[Click Here](#) to learn more about the United Nations’ SDG 9 targets and goals

SDG 9 Courses at YU	Primary SDG	Secondary SDG	Ancillary SDG	Total Courses
	215	0	0	215

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York University 2022 SDG Course Mapping - SDG 9

COURSE TITLE	FACULTY	SUBJECT	CODE	CREDIT	DESCRIPTION	LANGUAGE	PRIMARY SDG	SECONDARY SDG	ANCILLIARY SDG
The Anthropology of Outer Space	Faculty of Liberal Arts & Professional Studies	ANTH	3270	3	The Anthropology of Outer Space considers from an anthropological perspective human beings and our concerns beyond Earth, including: human and robotic exploration of the solar system; Mars analogs, simulations, and telepresence; telescope technologies which image the universe; the search for extraterrestrial life (astrobiology and SETI); the private spaceflight revolution; space and the military-industrial complex; and outer space in popular culture.	en	SDG 9 Industry, Innovation and Infrastructure		
Acquiring Research Skills	Faculty of Liberal Arts & Professional Studies	ANTH	3110	6	This introduction to the experience and practice of research in anthropology focuses on learning qualitative research skills within the context of a project design and implementation. Fieldwork methods, project design, ethics and analysis, as the tools of anthropological research, are explored in this course. Prerequisite: AP/ANTH 1110 6.00 (prior to Fall 2012) or AP/ANTH 2110 6.00 and a minimum of one 2000-level anthropology course.	en	SDG 9 Industry, Innovation and Infrastructure		
Advanced Virology	Faculty of Science	BIOL	4155	3	Investigates advanced concepts and experimental systems in virology, including recent basic and applied research that has led to major scientific innovations in medicine, agriculture and nanotechnology. Prerequisites: SC/BIOL 3110 3.00, SC/BIOL 3130 3.00, SC/BIOL 3155 3.00.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 3 Good Health and Well-Being	
Online International Business Transactions: Theory, Law, and Practice	Faculty of Graduate Studies	BLIS	6409	6	International Business Transactions uses case studies to analyze international business transactions including: forming the contract, financing and payment techniques, and identifying and addressing barriers to contract fulfillment. Examples include the study of import/export of goods and services, technology transfers, joint ventures and foreign direct investment. The course addresses the challenges of trans-border electronic transactions and doing business on the internet. The online nature of this course permits the students to engage in activities that simulate the remote, asynchronous nature of real-life cross-border, multi-party business transaction negotiation and documentation. Regular group work, problem-based learning, practical exercises, and research and writing assignments are required at key points during the course.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
International Business Transactions	Faculty of Graduate Studies	BLIS	6509	6	International Business Transactions uses case studies to analyze international business transactions, including forming the contract, financing and payment techniques, and identifying and addressing barriers to contract fulfillment. Examples include the study of import/export of goods and services, technology transfers, joint ventures and foreign direct investment. The course addresses the challenges of trans-border electronic transactions and doing business on the internet.	en	SDG 9 Industry, Innovation and Infrastructure		
Biomolecular Interactions	Faculty of Graduate Studies	CHEM	6050	3	This course covers advanced topics in biomolecular interactions including the role of affinity interactions in biology and technology, theory of affinity interactions, affinity methods, and advanced affinity probes. Course credit exclusion: Chemistry 5410 3.0 may not also be taken for credit.	en	SDG 9 Industry, Innovation and Infrastructure		

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Instrumental Methods of Chemical Analysis	Faculty of Science	CHEM	3080	4	The theory and application of a variety of common modern quantitative instrumental methods. Topics include calibrations; basic electronics; signal processing; optical systems; atomic and molecular absorption and emission spectroscopies; gas, liquid, and ion chromatography; and electroanalytical techniques. This course covers applications to modern chemical analysis of samples relevant to industry, medicine, environment, and others. Three lecture hours, three laboratory hours. One term. Four credits. Prerequisites: SC/CHEM 2080 4.00; SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.0 or SC/PHYS 1012 3.00 or SC/PHYS 1412 3.00 or SC/PHYS 1422 3.00 or SC/ISCI 1310 6.0 or SC/ISCI 1302 3.00. Course Credit Exclusions: SC/SENE 2081 3.00 and SC/SENE 2082 3.00	en	SDG 9 Industry, Innovation and Infrastructure		
Hydraulics	Lassonde School of Engineering	CIVL	3120	4	This course focuses on fluid flow including flow in pipes and open channels, under laminar and turbulent conditions, in steady or unsteady conditions, and flow through and past various objects. The course covers the equations of motions for fluids, differential fluid flow analysis, potential flow theory and the boundary layer approximation. Prerequisites: LE/CIVL 2210 3.00 or LE/CIVL 2210 4.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Advanced Structural Analysis	Lassonde School of Engineering	CIVL	4001	3	The course presents modern methods of structural analysis related to the computer-aided solution of statically indeterminate structures. The Virtual Work principle in Matrix Form is the basis of the course's development. Development of the matrix form of flexibility and stiffness methods of analysis. The Direct Stiffness Method. Matrix formulation and computer analysis. Application to structural systems including continuous beams, frames, and trusses, using modelling with advanced software platforms. Introduction to the finite element method. Prerequisite: LE/CIVL 3130 3.00	en	SDG 9 Industry, Innovation and Infrastructure		
Civil Engineering Design Project	Lassonde School of Engineering	CIVL	2000	3	Introduction to principles of engineering design via application to a suitable civil engineering project. Students work in groups of three or four, with periodic monitoring of group interaction and performance. Deliverables include a formal design report and a formal oral presentation in front of peers and invited guests. Students' learning experience is enhanced through guest lectures from prominent member of civil engineering industry and academia. Prerequisites: LE/ENG 2001 3.00, LE/CIVL 2150 3.00 Corequisite: LE/ENG 2003 3.00. Date of submission: 2017-12-05	en	SDG 9 Industry, Innovation and Infrastructure		

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Transportation Planning and Evaluation	Lassonde School of Engineering	CIVL	3260	3	This course introduces students to the major theories, principles and methods used in the field of transportation planning and evaluation. Under transportation planning, the course considers how transportation planners and decision-makers have historically analyzed the way people and goods move around cities. This includes an examination of the four-step travel demand model (the most widely used model) giving emphasis to the analytical techniques used to forecast future daily traffic demand on a roadway network. Under transportation project evaluation, the course presents fundamental concepts for the economic evaluation of roadway infrastructure improvement projects. Emphasis is placed on user and non-user costs with additional applications of lifecycle cost analysis, benefit-cost analysis, and the integration of these tools to support effective decision making. Prerequisites: LE/ENG 2001 3.00; LE/CIVL 3160 3.00 or LE/CIVL 3250 3.00. Course Credit Exclusion: LE/CIVL 4032 3.00.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 11 Sustainable Cities and Communities	SDG 8 Decent Work and Economic Growth
Structural Steel Design	Lassonde School of Engineering	CIVL	4003	3	Design of tension members, compression members, and beam-columns. Behaviour and design of composite steel beams. Design of plate girders. Local and lateral torsional buckling. Strength and stability of columns. Shear and tension strength of bolts, prying action, and design of base plates. Design of concrete filled steel tubular sections. Design of truss systems and design of bracing for sway systems and diaphragm action. Prerequisite: LE/CIVL 3230 3.00, LE/CIVL 3130 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Pavement Materials and Design	Lassonde School of Engineering	CIVL	4031	3	This course is intended to cover many of the key elements of surface infrastructure system (e.g., pavements). That is, the framework for good pavement design and management, pavement materials, and structural design. More specifically, the following topics will be covered. Properties and usage of soil and rock as pavement materials; selection and characterization of subgrade, sub-base and base materials; properties and usage of bitumen and asphalt; manufacture and use of bituminous concrete; mix design; use of recycled construction materials in road construction; prediction and characterization of traffic loadings; stress distribution in flexible and rigid pavements; principles of mechanistic design; assessment and prediction of pavement condition; measurement and reporting of physical distress including cracking, rutting and roughness, pavement management system. Prerequisites: LE/CIVL 3110 3.00; LE/CIVL 3250 3.00 or LE/CIVL 3260 3.00	en	SDG 9 Industry, Innovation and Infrastructure	SDG 12 Responsible Consumption and Production	
Popular Technologies and Cultural Practice	Faculty of Liberal Arts & Professional Studies	CLTR	2510	6	Examines the role of consumer technologies, ranging from the automobile to the iPod in terms of how they affect the cultural landscapes of contemporary culture and society.	en	SDG 9 Industry, Innovation and Infrastructure		

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Early Cinema to the Coming of Sound: 1895 - 1930	School of Arts, Media, Performance & Design	CMA	2200	3	Examines the emergence of cinema as a technology, cultural experience, economic structure, and means of artistic expression. Prerequisite: FA/CMA 1400 9.00 or 6.00.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Scene and Screen: Issues in Theatre, Performance, and Film	School of Arts, Media, Performance & Design	CMA	3362	3	Examines the historical, theoretical, and practical intersections of film, performance and theatre in work from the early twentieth century until today. Focus is on the changing relationship between film, performance and theatre in the face of changing discourses and technologies. Open to non-majors.	en	SDG 9 Industry, Innovation and Infrastructure		
Writing for Games & Interactive Media II	School of Arts, Media, Performance & Design	CMA	2123	3	This course investigates the ways that digital tools have changed our relationship to story and provides a detailed overview of what it takes to produce projects that combine story and technology. We will look at narrative traditions that precede the digital to understand the foundations of storytelling as an evolved and evolving form of meaning-making and then proceed through different digital storytelling modalities - textual, typographic, visual/auditory, cinematic and hypermedial - to arrive at an integrated approach to interactive, multilinear and immersive storytelling. We will analyze hypertext fiction, twine games, interactive cinema, videogames, Alternate Reality Games, and more. Our critical study will concern issues such as nonlinear narrative, network aesthetics, and videogame mechanics. Students will have an opportunity to respond to the ideas raised in this class through hands-on exploration of digital storytelling practice. Pre-requisites: FA/CMA 1123 3.0.	en	SDG 9 Industry, Innovation and Infrastructure		
History, Theory and Practice of Screenwriting	School of Arts, Media, Performance & Design	CMA	3830	3	Examines the history, theory and practice of screenwriting. It explores the ways in which the screenplay has been positioned in the film industry from the beginning of the 20th century to the present. Prerequisite: FA/CMA 1400 6.00 or permission of the Department of Film.	en	SDG 9 Industry, Innovation and Infrastructure		
Media Practice III	School of Arts, Media, Performance & Design	CMA	3101	8	Media Practice III builds on media fundamentals introduced in Media Practice I and II with a more in-depth concentration on developing creative projects that explore narrative and experience. Emphasis is placed on developing creative skills in virtual production and interactivity using game engines and 3D applications, while applying them in the making of interactive installations, XR projects, virtual filmmaking, or other discovered applications of these technologies. Special attention will be put on effectively incorporating composition, movement, sequence, form, light, and sound in media making. Pre-requisites: FA/CMA 1001, FA/CMA 1101, FA/CMA 2101. Pre- or Co-requisite: PANF 2100A or permission of the department.	en	SDG 9 Industry, Innovation and Infrastructure		

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Foundational Communication Theory	Faculty of Liberal Arts & Professional Studies	COMN	3100	3	Provides an overview of the foundations and theoretical approaches in communication theory. Special attention will be paid to mass communication theory, medium theory, audience research, semiotics, and the political economy of media. Course credit exclusion: AP/COMN 3320 6.00 (prior to Fall 2012).	en	SDG 9 Industry, Innovation and Infrastructure		
Digital Media and Culture	Faculty of Liberal Arts & Professional Studies	COMN	3550	3	Examines the origins and development of forms of digital media and culture with particular emphasis on how they differ from pre-digital or "analog" cultural forms. Upon establishing our theoretical foundations for considering new media as technology and culture, we investigate the historical development of digital technology and some of the transformative effects it has had, and continues to have, on previous forms of communication. Seminar discussions address themes such as identity, privacy, hardware/software, education, journalism, news, and interactivity, in relation to topics such as hypermedia, cyberspace, satellites, digital telephony, digital radio/music, digital photography/video, and digital literacy.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 4 Quality Education	SDG 16 Peace, Justice and Strong Institutions
Advanced Issues in Digital Media and Culture	Faculty of Liberal Arts & Professional Studies	COMN	3551	3	This course investigates some of the transformative effects of digital communications technologies within realms of culture as diverse as politics, romance and mating, industry, medical and pharmaceutical practice, commerce, finance, the arts, scientific enquiry, and contemporary warfare. Relevant to class discussions are phenomena such as world order transformation, cybernetics and automation, interoperability, databases, computer modeling, information overload, artificial intelligence, virtuality, networks, social networking, biometrics, and the global positioning system. The course concludes by addressing questions regarding what constitutes the good digital life.	en	SDG 9 Industry, Innovation and Infrastructure		
Feminist Perspectives on Technology	Faculty of Liberal Arts & Professional Studies	COMN	3591	3	Examines communication technologies from a feminist perspective. Various technologies from the telephone, television, cinema, computers, and the Internet are analyzed within historical relationships of gender. Course credit exclusion: AP/COMN 3393 6.00 (prior to Fall 2012).	en	SDG 9 Industry, Innovation and Infrastructure	SDG 5 Gender Equality	
Popular Culture and Communications	Faculty of Liberal Arts & Professional Studies	COMN	4700	6	Employing a variety of theoretical and methodological perspectives, this course examines the role of communications media and information and technology in the production and circulation of popular cultural artifacts and practices. Course credit exclusion: AP/COMN 4300 6.00 (prior to Fall 2012).	en	SDG 9 Industry, Innovation and Infrastructure	SDG 11 Sustainable Cities and Communities	
Advanced Communications Research Methods	Glendon College	COMS	4202	3	This bilingual course introduces students to advanced research methodologies and research tools in the field of communication studies. Students design and conduct their own research projects. Ce cours bilingue initie les v@tudiants aux mv@thodologies et aux outils de recherche avancv@e en communications. Ils conv@soivent et rv@alisent leurs propres projets de recherche. Prerequisite/Condition prv@alable : GL/COMS 1100 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		

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<p>Game Design and Prototyping I</p>	<p>School of Arts, Media, Performance & Design</p>	<p>DATT</p>	<p>2300</p>	<p>3</p>	<p>Introduces the essential workflows and requisite knowledge for game design and prototyping through the creation of non-digital game prototypes and an introduction to digital game engines. It provides an introductory hands-on approach to the study and practice of games, gamification, and gameplay and their use in various applications, including video games, simulations, serious gaming, and art-making contexts. The course takes a practical and theoretical approach to game production in a variety of gaming contexts. Emphasis is on introducing the basics of game mechanics and design and implementation in non-digital game environments such as board games, card games and tabletop games. Students are introduced to software tools and engines found in professional game development and the making of technology-based art practice. Open to non-majors. Prerequisite: Programming experience required.</p>	<p>SDG 9 Industry, Innovation and Infrastructure</p>		
<p>Physical Computing III: The Intersection of the Physical with the Virtual</p>	<p>School of Arts, Media, Performance & Design</p>	<p>DATT</p>	<p>4010</p>	<p>3</p>	<p>Builds on the material covered in Physical Computing II to explore more advanced topics in physical computing such as circuit board design, embedded computing, and communications, among other topics. Works created in this course will place emphasis on research-creation in the development of large-scale installation-based projects that explore the intersection of the physical and virtual worlds. This could include interactive architecture, responsive/interactive installation, and immersive experiences. During the course students will work in groups to develop a larger work for public presentation. Prerequisites: DATT 2010 3.0 Physical Computing II, or by permission of the instructor. Recommended: DATT3940/VISA3033 3D modelling for Fabrication, or equivalent experience.</p>	<p>SDG 9 Industry, Innovation and Infrastructure</p>		
<p>Introduction to Applied Statistics</p>	<p>Schulich School of Business</p>	<p>DCAD</p>	<p>7060</p>	<p>3</p>	<p>This course focuses on the use of univariate and multivariate statistics as applied to social and behavioural research within the fields of organizational, management, and consumer studies. It covers descriptive statistics, mean difference testing, analysis of variance and covariance, linear and logistic regression, and a priori sample size calculations, as well as power and effect size calculations.</p>	<p>SDG 9 Industry, Innovation and Infrastructure</p>		
<p>Research Design</p>	<p>Schulich School of Business</p>	<p>DCAD</p>	<p>7250</p>	<p>3</p>	<p>Introduces students to research design, strengthens their reasoning and theoretical development skills, helps them effectively apply a range of empirical methodologies to their own research and critically review empirical studies done by others. Topics include types of variables, relationships, sampling and measurement, survey and field research designs, experimental designs, and alternative designs, and research design biases and artifacts.</p>	<p>SDG 9 Industry, Innovation and Infrastructure</p>	<p>SDG 16 Peace, Justice and Strong Institutions</p>	

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Qualitative Methods	Faculty of Liberal Arts & Professional Studies	DEMS	4721	3	Provides an in-depth understanding of qualitative strategies for conducting interviews, focus groups and other methods of research in public sector and business and management roles. It also addresses practical and theoretical approaches to data collection and analysis and examines the value of qualitative research in contemporary management practices. Prerequisite: a minimum of 60 credits successfully completed, including AP/ADMS 2400 3.00. Course credit exclusion: AP/ADMS 4421 3.00 (prior to Fall 2019).	en	SDG 9 Industry, Innovation and Infrastructure		
Research Design and Qualitative Research Methods	Faculty of Graduate Studies	DEMS	5051	3	Students are provided with a comprehensive knowledge and understanding of various quantitative research methods and their applications in disaster and emergency management. Using statistical methods, students will learn to analyze data and formulate hypotheses and conceptual relationships.	en	SDG 9 Industry, Innovation and Infrastructure		
Communication Design Process	School of Arts, Media, Performance & Design	DESN	2001	3	Introduces a design thinking process for visual communication. Students are encouraged to establish methods through various design thinking stages to foster innovative results. Rather than focusing on visualization skills, the course stresses the importance of generating creative strategies for the enhancement of the user experience. Required course for BDes major. Prerequisite: FA/DESN 1001 3.00 and FA/DESN 1002 3.00 or permission of the Department of Design. Course credit exclusion: FA/YSDN 2004 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Designing for Human Interactions	School of Arts, Media, Performance & Design	DESN	2011	3	Examines systems of communication that move beyond singular artefacts by exploring more complex designed experiences that involve multiple levels of interaction. This course will consider the relationships between human purpose, material objects and the role of the designer within larger technological and social ecosystems. Required course for BDes majors. Prerequisite: FA/DESN 1011 3.0.	en	SDG 9 Industry, Innovation and Infrastructure		
Evolution of Information Design	School of Arts, Media, Performance & Design	DESN	2112	3	Examines the origin and development of designed artifacts to provide clarity and enable understanding of complex data, processes, and environments. It considers influencing factors of social, technological and historical developments in the representation of information. Using a blended course model, classes alternate weekly between face-to-face and online meetings. Prerequisite: FA/DESN 1111 3.00. Course credit exclusion: FA/YSDN 2108 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		

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Foundations of Digital Media	Faculty of Graduate Studies	DIGM	5010	3	Students learn the essential skills of postgraduate-level research in areas of digital media and computational arts, and attain core literacies in mathematical and computational bases for digital media to support applications spanning areas including sound, image, and digital signal processing, 3D environments and the graphics pipeline, software design, simulation and complex systems, etc. These literacies are contextualized by reference to exemplary projects in diverse practices such as computational art, music, video games, information visualization, web-based media, responsive architecture, physical computing, etc., including the examination of landmark texts and projects in digital media, computational arts and culture spanning the past century, addressing the continual overlap between artistic and scientific practices. Literacy is evaluated through the ability to understand and transfer published research in these fields into creative applications, recreating established research results, projects, or through works of specific interest to the student–is research area(s).	en	SDG 9 Industry, Innovation and Infrastructure	SDG 4 Quality Education	
Manufacturing and Service Operations Management	Faculty of Graduate Studies	DMGM	5030	1.5	In this course, we review classic qualitative and quantitative models in manufacturing and service operations management.	en	SDG 9 Industry, Innovation and Infrastructure		
Industrial Organization	Faculty of Liberal Arts & Professional Studies	ECON	3200	3	Studies the non-strategic and strategic behaviour of firms and industrial organizations under different markets structures, with emphasis on imperfectly competitive markets. Topics include pricing and non-pricing strategies, vertical and horizontal restraints, entry deterrence, advertising, investment, and innovation. Prerequisite: AP/ECON 1000 3.00 or equivalent. Course credit exclusion: GL/ECON 3370 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Data Analysis and Empirical Strategies	Faculty of Graduate Studies	ECON	5280	3	This course focuses on the methodological and practical issues that arise when economists harness data to answer questions of economic and policy interest. This course covers techniques in modern data analysis for cross-section and panel settings: regression and instrumental variables, regression discontinuity, differences-in-differences, with an emphasis on data visualization and program evaluation. Projects include analysis of data with a written description and interpretation of results; may involve gathering of original data or use of existing data sets. Applications drawn from real world examples and frontier research. Instruction in use of the statistical package R and/or Stata.	en	SDG 9 Industry, Innovation and Infrastructure		
Industrial Organization	Faculty of Graduate Studies	ECON	5430	3	An examination of certain aspects of monopoly, oligopoly and competition among them: product selection and quality; vertical controls; strategic behaviour and innovation games.	en	SDG 9 Industry, Innovation and Infrastructure		

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Empirical International Trade	Faculty of Graduate Studies	ECON	5820	3	This course covers the empirical aspects of international trade. Topics include: tests of international trade theories; empirical studies of the relationship between international trade and labour markets, effects of trade and foreign direct investment on developing countries, productivity and its relation to international trade, and effects of the FTA and NAFTA on Canadian Economy.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Human-Computer Interaction	Faculty of Graduate Studies	EECS	5351	3	Introduces the concepts and technology necessary to design, manage and implement interactive software. Students work in small groups and learn how to design user interfaces, how to realize them and how to evaluate the end result. Both design and evaluation are emphasized.	en	SDG 9 Industry, Innovation and Infrastructure		
Information Networks	Faculty of Graduate Studies	EECS	5414	3	Information networks are effective representations of pairwise relationships between objects. Examples include technological networks (e.g., the Web), social networks (e.g., Facebook), biological networks (e.g., protein-to-protein interactions), and more. Analysis of information networks is an emerging discipline of immense importance. This course provides students with theoretical knowledge and practical experience of the field by covering models and algorithms of information networks.	en	SDG 9 Industry, Innovation and Infrastructure		
Computer Architecture	Faculty of Graduate Studies	EECS	5501	3	This course presents the core concepts of computer architecture and design ideas embodied in many machines and emphasizes a quantitative approach to cost/performance tradeoffs. This course concentrates on uniprocessor systems. A few machines are studied to illustrate how these concepts are implemented; how various tradeoffs that exist among design choices are treated; and how good designs make efficient use of technology. Future trends in computer architecture are also discussed. Integrated with the undergraduate course Computer Science 4201.03.	en	SDG 9 Industry, Innovation and Infrastructure		
Machine Learning Theory	Faculty of Graduate Studies	EECS	6127	3	This course takes a foundational perspective on machine learning and covers some of its underlying mathematical principles. Topics range from well-established results in learning theory to current research challenges. We start with introducing a formal framework, and then introduce and analyze learning methods, such as Nearest Neighbors, Boosting, Support Vector Machines (SVMs) and Neural Networks. Finally, students present and discuss recent research papers.	en	SDG 9 Industry, Innovation and Infrastructure		
Privacy in Sociotechnical Systems: Theory and Applications	Faculty of Graduate Studies	EECS	6350	3	This course covers theory and application of digital privacy in sociotechnical systems. The first half of the course focuses on a privacy analysis of technologies that both enhance and threaten privacy through the lenses of law, policy, and theory. The second half covers topics on user privacy like profiling, online tracking, and anonymization. The evaluation is project-based.	en	SDG 9 Industry, Innovation and Infrastructure		
Data Mining	Faculty of Graduate Studies	EECS	6412	3	Introduces fundamental concepts of data mining. It presents various data mining technologies, algorithms and applications. Topics include association rule mining, classification models, sequential pattern mining and clustering.	en	SDG 9 Industry, Innovation and Infrastructure		

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Introduction to Robotics	Faculty of Graduate Studies	EECS	5324	3	Introduces concepts in Robotics. The course begins with a study of the mechanics of manipulators and robot platforms. Trajectory and course planning, environmental layout and sensing are discussed. Finally, high-level concerns are introduced. The need for real-time response and dynamic-scene analysis are covered, and recent development in robotics systems from an Artificial Intelligence viewpoint are discussed.	en	SDG 9 Industry, Innovation and Infrastructure		
Mobile Communications	Faculty of Graduate Studies	EECS	5431	3	Provides an overview of the latest technology, developments and trends in wireless mobile communications, and addresses the impact of wireless transmission and user mobility on the design and management of wireless mobile systems.	en	SDG 9 Industry, Innovation and Infrastructure		
Software Re-Engineering	Faculty of Graduate Studies	EECS	6431	3	Industrial software systems are usually large and complex, while knowledge of their structure is either lost or inadequately documented. This course presents techniques that aid the comprehension and design recovery of large software systems.	en	SDG 9 Industry, Innovation and Infrastructure		
Engineering Optimization	Faculty of Graduate Studies	EECS	6808	3	This course introduces classical and modern optimization techniques to solve engineering analysis and design problems. Students will learn how to formulate single- and multi-variable engineering problems as optimization problems and how to solve such problems using appropriate optimization techniques. The details of specific techniques required to solve the formulated problems will be discussed from theory and application points of view.	en	SDG 9 Industry, Innovation and Infrastructure		
Computational Thinking through Mechatronics	Lassonde School of Engineering	EECS	1011	3	The Objectives of 1011 are threefold: providing a first exposure to procedural programming, teaching students a set of soft computing skills (such as reasoning about algorithms, tracing programs, test-driven development), and demonstrating how computers are used in a variety of engineering disciplines. It uses problem-based pedagogy to expose the underlying concepts and an experiential laboratory to implement them. An integrated computing environment (such as MATLAB) is used so that students can pick up key programming concepts (such as variables and control flow) without being exposed to complex or abstract constructs. The problems are chosen with consultation with the various engineering disciplines in the Faculty with a view of exposing how computing is used in these disciplines. Course credit exclusions: LE/EECS1541 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		

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<p>Introduction to Computing: A Net-centric Approach</p>	<p>Lassonde School of Engineering</p>	<p>EECS</p>	<p>1012</p>	<p>3</p>	<p>The objectives of 1012 are threefold: providing a first exposure to event-driven programming, teaching students a set of computing skills (including reasoning about algorithms, tracing programs, test-driven development, unit testing), and providing an introduction to computing within a mobile, net-centric context. It uses problem-based approach to expose the underlying concepts and an experiential laboratory to implement them. A mature mobile software infrastructure (such as HTML, CSS, and JavaScript) is used so that students can pick up key programming concepts (such as variables and control flow) within a client-server context without being bogged down in complex or abstract constructs. Laboratory exercises expose students to a range of real-world problems with a view of motivating computational thinking and grounding the material covered in lecture. Prerequisites: One of (1)-(3) below must be met: (1) (New high school curriculum): One 4U Math course with a grade of at least 75%. (2) Completion of six credits from York University MATH courses (not including courses with second digit 5) with a GPA of 5.00 or better over these credits; (3) Completion of six credits from York University mathematics courses whose second digit is 5, with an average grade not below 7.00 (B+). Course credit exclusions: AP/ITEC 3020 3.00, SC/CSE 2041 4.00 (prior to Summer 2013) Previously offered as: LE/CSE 2041 4.00, LE/EECS 2041 4.00.</p>	<p>en</p>	<p style="text-align: center;">SDG 9 Industry, Innovation and Infrastructure</p>	
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<p>Introduction to Computer Science and Programming</p>	<p>Lassonde School of Engineering</p>	<p>EECS</p>	<p>1015</p>	<p>3</p>	<p>This course is an introduction to the concepts and tools of computer science as students learn a procedural subset of the Python programming language. Python has a variety of libraries in different domains allowing for the solution of interesting problems which has made it a popular language in industry and the academy. Students do hands-on work to design, write, debug and test computer programs that solve problems computationally. Students study variables, assignments, expressions (arithmetic, relational and logical) and sequencing of statements to implement solutions for computational problems, in Python. They document programs with comments and preconditions. They analyze the type correctness of programs via a type checker. They use an Integrated Development Environment (IDE) to develop, unit-test and debug programs given a problem specification. They apply conditionals (including nested conditionals) to implement algorithms to solve computational problems. They code functions to develop modular programming solutions for computational problems. They apply Python loops (including nested loops) to implement algorithms to solve computational problems. They apply data structures, including tuples, sets, lists and dictionaries, to implement algorithms to solve computational problems. They code simple recursive functions to implement algorithms to solve computational problems. Prerequisites: One of (1)-(3) below must be met: (1) (New high school curriculum): One 4U Math course with a grade of at least 75%. (2) Completion of six credits from York University MATH courses (not including courses with second digit 5) with a GPA of 5.00 or better over these credits; (3) Completion of six credits from York University mathematics courses whose second digit is 5, with an average grade not below 7.00 (B+).</p>	<p>SDG 9 Industry, Innovation and Infrastructure</p>		
<p>Introduction to Object Oriented Programming</p>	<p>Lassonde School of Engineering</p>	<p>EECS</p>	<p>1022</p>	<p>3</p>	<p>Provides a first exposure to object-oriented programming and enhances student understanding of key computing skills such as programming with objects and simple data structures (e.g., arrays, linked lists), reasoning about algorithms, and working with software tools. It uses a problem-based approach to expose the underlying concepts and an experiential laboratory to implement them. A mature Integrated Development Environment (such as Java and the Eclipse programming, testing, and debugging environment) is used to expose and provide context to the underlying ideas. Laboratory exercises expose students to a range of real-world problems with a view of motivating computational thinking and grounding the material covered in lectures. Prerequisites: LE/EECS 1012 3.00 or LE/EECS 1015 3.00. Course credit exclusions: LE/EECS 1021 3.00, LE/EECS 1020 3.00, LE/CSE 1020 3.00, SC/CSE 1020 3.00, AP/ITEC 1620 3.00.</p>	<p>SDG 9 Industry, Innovation and Infrastructure</p>		

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Computer Organization	Lassonde School of Engineering	EECS	2021	4	Introduction to computer organization and instruction set architecture, covering assembly language, machine language and encoding, addressing modes, single/multicycle datapaths (including functional units and controls), pipelining, memory segments and memory hierarchy. Prerequisites: cumulative GPA of 4.50 or better over all major EECS courses (without second digit "5"); LE/EECS 1021 3.00 or LE/EECS 1022 3.00 or LE/EECS 1720 3.00 or LE/EECS 1030 3.00. Previously offered as: LE/CSE 2021 4.00, SC/CSE 2021 4.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Digital Logic Design	Lassonde School of Engineering	EECS	3201	4	Theory, analysis, and design of logic circuits used in digital systems. Students will be introduced to design of switching circuits to implement logic gates, digital number representation and arithmetic circuits. They will learn how to use logic gates to construct combinational and sequential logic circuits and functional blocks. The course and the laboratory introduces the students to hardware description language and modern cad tools. Prerequisites: Cumulative GPA of 4.50 or better over all major EECS courses.(without second digit of '5) LE/EECS 1021 3.00 or LE/EECS 1022 3.00; SC/PHYS 1012 or SC/PHYS 1412 or SC/PHYS 1422 or SC/PHYS 1801 3.0 or SC/PHYS 1010	en	SDG 9 Industry, Innovation and Infrastructure		
Building E-Commerce Systems	Lassonde School of Engineering	EECS	4413	3	A study of the technical infrastructure that underlies Electronic Commerce on the Internet. The foundational concepts are presented through a series of projects that use an industrial-strength framework on the server side, standard-compliant technologies on the client side, and a variety of messaging protocols on the network side. Best practices, security concerns, and performance issues are emphasized throughout. Prerequisite: Cumulative GPA of 4.50 or better over all major EECS courses (without second digit "5"); LE/EECS 2030 3.00 or LE/EECS 1030 3.00. Previously offered as: LE/CSE 4413 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		

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Big Data Systems	Lassonde School of Engineering	EECS	4415	3	<p>Storing, managing, and processing datasets are foundational to both computer science and data science. The enormous size of today's data sets and the specific requirements of modern applications necessitated the growth of a new generation of data management systems, where the emphasis is put on distributed and fault-tolerant processing. New programming paradigms have evolved, an abundance of information platforms offering data management and analysis solutions appeared and a number of novel methods and tools have been developed. This course introduces the fundamentals of big data storage, retrieval, and processing systems. As these fundamentals are introduced, exemplary technologies are used to illustrate how big data systems can leverage very large data sets that become available through multiple sources and are characterized by diverse levels of volume (terabytes; billion records), velocity (batch; real-time; streaming) and variety (structured; semi-structured; unstructured). The course aims to provide students with both theoretical knowledge and practical experience of the field by covering recent research on big data systems and their basic properties. Students consider both small and large datasets because both are equally important and justify different trade-offs. Topics include: software frameworks for distributed storage and processing of very large data sets, MapReduce programming model, querying of structured data sets, column stores, key-value stores, document stores, graph databases, distributed stream processing frameworks. Prerequisites: Cumulative GPA of 4.50 or better over all major EECS courses (without second digit "5"), LE/EECS 3421 3.00, LE/EECS 3101 3.00</p>	en	<p style="text-align: center;">SDG 9 Industry, Innovation and Infrastructure</p>		
Human-Computer Interaction	Lassonde School of Engineering	EECS	4441	3	<p>Introduces the concepts and technology necessary to design, manage and implement interactive software. Students work in small groups and learn how to design user interfaces, how to realize them and how to evaluate the end result. Both design and evaluation are emphasized. Prerequisites: cumulative GPA of 4.50 or better over all major EECS courses (without second digit "5"); LE/EECS 2030 3.00 or LE/EECS 1030 3.00; LE/EECS 3461 3.00. Previously offered as: LE/CSE 4441 3.00.</p>	en		<p style="text-align: center;">SDG 9 Industry, Innovation and Infrastructure</p>	

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Object Oriented Programming from Sensors to Actuators	Lassonde School of Engineering	EECS	1021	3	<p>&quot;Introduces student to computational thinking - a process-based approach to problem solving. It uses a problem-based pedagogy to expose the underlying concepts and an experiential laboratory to implement them. The programming language is chosen so that it is widely used in a variety of applications, is object-oriented, and is of industrial strength (Java is an example of such a language). The problems are chosen in order to expose abstract programming concepts by immersing them in relevant and engaging applications. The experiential laboratory is based on sensors and actuators that connect to a computer. The problems are chosen with consultation with the various engineering disciplines in the Faculty with a view of exposing how computing is used in these disciplines. Prerequisites: LE/EECS1011 3.00. Course credit exclusions: LE/EECS 1022 3.00. Previously offered as: LE/EECS1020 3.00, LE/CSE 1020 3.00.</p>	en	SDG 9 Industry, Innovation and Infrastructure		
Introduction to Artificial Intelligence and Logic Programming	Lassonde School of Engineering	EECS	3401	3	<p>Artificial Intelligence (AI) deals with how to build intelligent systems. In this course, we examine fundamental concepts in AI: knowledge representation and reasoning, search, constraint satisfaction, reasoning under uncertainty, etc. The course also introduces logic programming and Prolog. Prerequisites: cumulative GPA of 4.50 or better over all major EECS courses (without second digit &quot;5&quot;); LE/EECS 2030 3.00 or LE/EECS 1030 3.00; LE/EECS 2011 3.00; MATH 1090 3.00. Previously offered as: LE/CSE 3401 3.00. PRIOR TO FALL 2014: course credit exclusion: LE/CSE 3402 3.00. PRIOR TO SUMMER 2013: course credit exclusions: SC/CSE 3401 3.00, SC/CSE 3402 3.00.</p>	en	SDG 9 Industry, Innovation and Infrastructure		
Analog Electronics	Lassonde School of Engineering	EECS	3611	4	<p>This course focuses on the analysis and design of analog electronic circuits in bipolar and CMOS technology. It covers the aspects of circuit design from single transistor operation to complex amplifiers, operational amplifiers and feedback. Prerequisites: Cumulative GPA of 4.50 or better over all major EECS courses (without second digit &quot;5&quot;); LE/EECS 2210 3.00.</p>	en	SDG 9 Industry, Innovation and Infrastructure		
Product Management for Technology Companies	Schulich School of Business	EMBA	6020	2	<p>This course equips students with the frameworks, tools and direct experience to become effective technology product managers (whether as entrepreneurs or intrapreneurs). Students will gain hands on experience via an industry-sponsored project and targeted cases–including several cases developed specifically for this course.</p>	en	SDG 9 Industry, Innovation and Infrastructure		
Human and Machine Intelligence: Creating Business Value Through Artificial Intelligence	Schulich School of Business	EMBA	6600	2	<p>This course covers cutting edge research on machine-learning and artificial intelligence and its applications for business leaders. Using hands-on cases and applications it shows how to use a critical set of machine learning decision tools, including natural language processing, sentiment analysis, and pattern recognition, to discover new competitive strategies, turn raw numbers into convincing stories, and make less biased judgments.</p>	en	SDG 9 Industry, Innovation and Infrastructure		

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Entrepreneurial Finance and Venture Capital	Schulich School of Business	EMBA	6630	2	This course will focus on financing issues facing new, young, high growth business ventures. The course will provide an in depth exploration of how startup ventures are funded, evaluated and valued by investors. We will explore business models and business plans, the major types of risks faced by start-up ventures and considered by investors, valuation methods and eventual exit. Further, we will explore tools and approaches used when selling an idea to potential investors. The Venture Capital industry -- its structure, common terminology and usage, as well as its contracting environment -- will be explored in detail.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Marketing	Schulich School of Business	EMBA	5180	2	This course helps students to understand contemporary marketing practices based on traditional transactional perspectives versus contemporary relationship and network perspectives. Key concepts and controversies in marketing are explored by comparing practices in contrasting contexts such as business-to-consumer versus business-to-business markets. The impacts of globalization, technological developments, socio-cultural changes and high velocity competition on the emergence and implementation of marketing strategy are examined.	en	SDG 9 Industry, Innovation and Infrastructure		
Venture Capital - What's it all about	Schulich School of Business	EMBA	6790	2	Introduces the Venture Capital (VC) industry. The players of the industry and their respective roles will be presented and discussed. Participants will experience the life cycle of investment decisions and will learn the VC game plan and best practices of the industry. The course will allow the participants to be knowledgeable and effective "players" if they eventually consider a VC-backed financing for their venture, or decide to be a part of the industry. Prerequisite: Students must have completed all EMBA foundation courses.	en	SDG 9 Industry, Innovation and Infrastructure		
Engineering Project (Capstone)	Lassonde School of Engineering	ENG	4000	6	The project will include significant elements of design and implementation. The format is intended to resemble engineering projects in practice, including specifications, background research, innovative solutions, analysis, testing and communication. 2 terms. Prerequisite(s): 21 3000-level science or engineering credits in the Engineering Program, exclusive of LE/ENG 3000 3.00. Prerequisite or corequisite: LE/ENG 3000 3.00. Course credit exclusions: CIVL4000 , ESSE4000.	en	SDG 9 Industry, Innovation and Infrastructure		
Business Essentials for Technology Entrepreneurs I	Schulich School of Business	ENTR	3400	3	This course has three modules: Organizational Behavior develops skills/knowledge of leadership, teamwork, negotiations and motivation. Marketing presents marketing strategy fundamentals. Operations Management reviews business processes to maximize supply under resource constraints. Prerequisite: completion of 30 engineering credits. Note: Open to students in the Lassonde School of Engineering or by permission of the Instructor and Lassonde Student Services.	en	SDG 9 Industry, Innovation and Infrastructure		

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Field Study: Innovating with Entrepreneurs, Unlocking New Venture Potential	Schulich School of Business	ENTR	4400	3	Provides students with firsthand experience of the opportunities and challenges growing organizations face. Student groups are paired with an entrepreneurial firm to research an opportunity or project for the firm. Limited classes emphasize consulting, market research and presentation skills. Prerequisites: Completion of all year 1 and year 2 core courses.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Entrepreneurship and New Venture Creation	Schulich School of Business	ENTR	4600	3	Explores the many dimensions of new venture creation and growth and fosters innovation and new business formations. The focus will be on content and process questions as well as on formulation and implementation issues that relate to conceptualizing, developing and managing successful new ventures. Note: open to fourth-year BBA and iBBA students only. Course Credit Exclusion: SB/ENTR 4500 3.00.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Business Essentials for Technology Entrepreneurs II	Schulich School of Business	ENTR	3600	3	This course has three modules: Accounting presents financial accounting fundamentals for business planning; Finance presents finance fundamentals to enable fund raising and resource allocation decisions; Strategy explores competitive analysis and strategic planning. Prerequisite: completion of 30 engineering credits. Note: Open to students in the Lassonde School of Engineering or by permission of the Instructor and Lassonde Student Services. Former prerequisite: completion of 60 credits in the major.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Mentorship Match: Learning to Innovate with Venture Leaders	Schulich School of Business	ENTR	6960	6	This experiential learning course offers the opportunity for MBA/IMBA students to accelerate their understanding of entrepreneurship and earn credit for gaining relevant work experience –ñ under the direct on-site mentorship and guidance of a handpicked Innovation Sector Founder or Venture Investment Leader.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Business and Sustainability: Issues and Strategies	Faculty of Environmental & Urban Change	ENVS	3505	3	An introduction to key dimensions of business and sustainability including: what is sustainability?; "values-driven"; business models and practices; eco-production in key economic sectors (food, manufacturing, energy, building); financing sustainability; indicators of sustainability; green regulation; and green business strategies. Prerequisite: Third- year or fourth- year standing or by permission of the Instructor.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Cloud Physics and Radar Meteorology	Faculty of Graduate Studies	ESS	5205	3	Thermodynamics of cloud processes. Buoyancy and convection. Weather radar. Storms and associated precipitation. Cloud droplet formation and growth of ice crystals. Snow, graupel and hail. Microphysical processes and climate. Prerequisite or corequisite: SC/EATS 3030 3.00.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 13 Climate Action	

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Mobile Mapping Systems (MMS)	Faculty of Graduate Studies	ESS	5440	3	The course covers research, development and technology topics about the use of manned and unmanned aerial and ground mobile mapping systems for geomatics applications. It is a project-focused course that provided students with knowledge on types of Mobile Mapping Systems (MMS), mobile mapping concepts, route planning, sensor position and orientation, navigation and mapping sensors, data acquisition, data processing and computational aspects, and geo-product generation and applications. Pre / co-requisites: background in photogrammetry, image processing, reference coordinate systems, Global Navigation Satellite Systems (GNSS), sensor integration, data analysis and optimization, computer programming.	en	SDG 9 Industry, Innovation and Infrastructure		
Remote Sensing of the Atmosphere	Faculty of Graduate Studies	ESS	5230	3	A study of the theory, instrumentation and applications of remote sensing methods of terrestrial and planetary atmospheres from space platforms. Topics include atmospheric radiation, atmospheric spectroscopy, inversion theory, instrumentation, satellites, space platforms and future technology. Prerequisites: SC/EATS 2010 3.00 or SC/PHYS 2060 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00. Prerequisite or corequisite: SC/EATS 3030 3.00 or permission of the Instructor.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 13 Climate Action	
Cloud Physics and Radar Meteorology	Lassonde School of Engineering	ESSE	4120	3	Thermodynamics of cloud processes. Buoyancy and convection. Weather radar. Storms and associated precipitation. Cloud droplet formation and growth of ice crystals. Snow, graupel and hail. Microphysical processes and climate. Prerequisite or corequisite: LE/ESSE 3030 3.00. PRIOR TO FALL 2014: Prerequisite or corequisite: LE/EATS 3030 3.00. PRIOR TO SUMMER 2013: Prerequisite or corequisite: SC/EATS 3030 3.00.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 13 Climate Action	
Payload Design	Lassonde School of Engineering	ESSE	4360	3	This course provides students with a comprehensive and accurate approach for the specification and detailed design of different spacecraft payloads, including optical payload, microwave payload, communications payload, and planetary exploration payload. Reliability analysis and its application will also be covered for space systems. Payload design projects will be assigned to students during the course. Three lecture hours per week. Prerequisites: LE/ENG 2001 3.00, LE/ESSE 3280 3.00 Date of submission: 2013-12-03 (Added most recent prerequisites from 2018-02-06)	en	SDG 9 Industry, Innovation and Infrastructure		

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Advanced 3D Geospatial Techniques	Lassonde School of Engineering	ESSE	4690	3	Advanced 3D geospatial techniques for data extraction from imaging and ranging sensors (optical, radar and lidar), 3D modeling, 3D data management and Internet mapping using emerging and multidisciplinary technologies in 3D geospatial information science and engineering. Prerequisites: LE/ESSE 3600 3.00; LE/ESSE 3650 3.00 or LE/ENG 3150 4.00; ES/ENVS 4521 3.00; or equivalent. PRIOR TO FALL 2014: Prerequisites: LE/EATS 3300 3.00; LE/EATS 3650 4.00 or LE/ENG 3150 4.00; ES/ENVS 4521 3.00; or equivalent. PRIOR TO SUMMER 2013: Prerequisites: SC/EATS 3300 3.00; SC/EATS 3650 4.00 or SC/ENG 3150 4.00; ES/ENVS 4521 3.00; or equivalent.	en	SDG 9 Industry, Innovation and Infrastructure		
Planetary Geophysics	Lassonde School of Engineering	ESSE	2030	3	This course analyzes the nature and usefulness of numerous geophysical tools for terrestrial and planetary exploration and in geologic observations. Tools include radar sounding and synthetic aperture radar, seismic waves, earthquake fault plane solutions, geochronology, gravity, paleomagnetism, rock magnetism, and thermal physics for Earth, the moon, and the terrestrial planets. Prerequisites: SC/PHYS 1012 3.00; or SC/PHYS 1010 6.00; or any of the following acceptable substitutes: SC/PHYS 1801 3.00; or SC/ISCI 1310 6.00; or SC/ISCI 1302 3.00; or any of the following with a minimum grade of C in each course: SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1412 3.00; SC/PHYS 1422 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Algorithmic and Computational methods for Geomatics and Space Engineering	Lassonde School of Engineering	ESSE	2220	3	This course provides a basis for the design, development and implementation of computational algorithmic methods specifically for applied geomatics and space engineering applications and trains students to obtain essential skills in algorithmic development for problem solving through the usage of commonlyused industry software tools and programming language(s), and mathematical and statistical algorithms. Examples and applications explored come from the broad common interests in Space Science & Engineering, and Geomatics Science & Engineering. Pre-requisite(s): LE/ENG 1102 4.00, LE/EECS 1021 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; SC/PHYS 1801 3.00. Course Credit Exclusion: EECS 2030 3.00, EECS 2031 3.00, EECS 2032 3.00. Date of submission: February 6, 2018	en	SDG 9 Industry, Innovation and Infrastructure		
Space Systems Engineering	Lassonde School of Engineering	ESSE	2361	3	The objective of this course is to provide the student with an introduction to systems engineering with an emphasis on the following topics: the systems engineering process, requirements, design fundamentals, subsystem fundamentals, trade studies, integration, technical reviews, and case studies. The course is also intended to prepare the student for the payload/mission design courses (LE/ESSE 4360 3.00 and LE/ESSE 4361 3.00) which are more application oriented.	en	SDG 9 Industry, Innovation and Infrastructure		

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Microsystems Technology	Lassonde School of Engineering	ESSE	3320	3	The course covers the principles and implementations of miniaturised sensors and actuators in a range of physical domains, such as optical, magnetic, thermal, and mechanical systems. Examples include electronic cameras, micro-electro-mechanical systems, thermal microsystems and display technologies. Prerequisite: SC/PHYS 2020 3.00	en	SDG 9 Industry, Innovation and Infrastructure		
Synoptic Meteorology II	Lassonde School of Engineering	ESSE	4051	3	Synoptic and mesoscale weather systems with emphasis on prediction: focus on forecasting with emphasis on the interpretation of numerical weather prediction models such as the GEM, MC2 and SEF models. Satellite and radar image interpretation for nowcasting. Prerequisite: LE/ESSE 4050 3.00. PRIOR TO FALL 2014: Prerequisite: LE/EATS 4050 3.00. PRIOR TO SUMMER 2013: Prerequisite: SC/EATS 4050 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Dynamics of Space Vehicles	Lassonde School of Engineering	ESSE	4110	3	This course presents a coherent and unified framework for mathematical modeling and analysis of space vehicles. The course can be divided into two main parts: orbit dynamics and attitude dynamics and control. The topics covered by this course include two-body problem, coordinate transformation, orbital elements, perturbation theory, orbital maneuvers, relative motion and rendezvous, interplanetary trajectories, rocket dynamics, and attitude dynamics and control. Spacecraft dynamics and control problems of practical interests are treated from a dynamical systems point of view. This course will focus on a comprehensive treatment of spacecraft dynamics and control problems and their practical solutions. Prerequisites: SC/PHYS 2010 3.00 or LE/ESSE 2470 3.00; SC/MATH 2271 3.00. Course Credit exclusion: SC/PHYS 4110 3.00	en	SDG 9 Industry, Innovation and Infrastructure		
Remote Sensing of the Atmosphere	Lassonde School of Engineering	ESSE	4230	3	An introduction to and summary of the area of remote sensing of the atmosphere from space platforms and from the ground. Topics include atmospheric radiation, atmospheric spectroscopy, inversion theory, instrumentation, satellites, space platforms and future technology. Prerequisites: LE/ESSE 2010 3.00 or SC/PHYS 2060 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00. Prerequisite or corequisite: LE/ESSE 3030 3.00 or permission of the Instructor. PRIOR TO FALL 2014: Prerequisites: LE/EATS 2010 3.00 or SC/PHYS 2060 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00. Prerequisite or corequisite: LE/EATS 3030 3.00 or permission of the Instructor. PRIOR TO SUMMER 2013: Prerequisites: SC/EATS 2010 3.00 or SC/PHYS 2060 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00. Prerequisite or corequisite: SC/EATS 3030 3.00 or permission of the Instructor.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 13 Climate Action	

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Space Mission Design	Lassonde School of Engineering	ESSE	4361	3	<p>This course covers the basic aspects of space mission design from a “blank sheet”. It includes mission design structure using systems engineering approaches to the design problem. Mission design starts with a set of mission objectives and aims to develop a viable solution for meeting these objectives given a set of technical cost and programmatic constraints. This course brings together systems engineering, mission types, objectives, technical readiness, risk mitigation, mission subsystems, and cost estimation. Prerequisites: LE/ESSE 4360 3.00 or permission of the Instructor.</p>	en	SDG 9 Industry, Innovation and Infrastructure		
Finite Element Methods in Engineering Design	Lassonde School of Engineering	ESSE	4370	3	<p>Basic principles of finite element method, variational and weighed residual principle procedures in discretizing and building up governing equations of physical models. Use of industrial FEM codes to understand model response to external effects such as stress, heat, vibration, and fluids. Prerequisites: SC/MATH 2271 3.00; LE/ESSE 2470 3.00.</p>	en	SDG 9 Industry, Innovation and Infrastructure		
Space Hardware	Lassonde School of Engineering	ESSE	4350	6	<p>Explores the theoretical, practical and experimental techniques needed to acquire and manipulate typical signals used in spacecraft system operations or integration and testing. Three laboratory hours and two lecture hours per week. Prerequisites: SC/PHYS 3150 3.00; SC/PHYS 3250 3.00</p>	en	SDG 9 Industry, Innovation and Infrastructure		
Regulation of Blockchain Technology and Cryptocurrencies	Faculty of Graduate Studies	FACC	6885	3	<p>This course examines the current legal, regulatory and governance issues surrounding the emerging blockchain and cryptocurrency technologies including future applications of blockchain in disrupting traditional banking (Fintech) and other industries.</p>	en	SDG 9 Industry, Innovation and Infrastructure	SDG 16 Peace, Justice and Strong Institutions	
Future Cinema	Faculty of Graduate Studies	FILM	6245	3	<p>Examines the shift from traditional cinematic spectacle to works probing the frontiers of interactive, performative, and networked media. Drawing upon a broad range of scholarship, including film theory, communication studies, cultural studies and new media theory, the course will consider how digital technologies are transforming the semiotic fabric of contemporary visual culture. Our focus will be on the phenomenon Gene Youngblood described three decades ago as “expanded cinema”—an explosion of the frame outward towards immersive, interactive and interconnected (i.e., environmental) forms of culture.</p>	en	SDG 9 Industry, Innovation and Infrastructure	SDG 11 Sustainable Cities and Communities	
Future Cinema II: Applied Theory	Faculty of Graduate Studies	FILM	6246	3	<p>This hands-on course gives students an opportunity to learn about new screen technologies, approaches and techniques in a lab environment. Students will work in the lab to build prototypes that will function as a testing ground for both new technology and future cinema theory. Our method is iterative: there is an urgent need for scholars in this field to be both theorists and practical experimenters, to research while doing, understanding that the process of exploring firsthand is an important step toward knowing what kinds of knowledges and ways of understanding these new digital tools and artefacts demand, encourage or make possible.</p>	en	SDG 9 Industry, Innovation and Infrastructure		

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Technological Worlds: Geographies of Digital Capitalism	Faculty of Environmental & Urban Change	GEOG	3150	3	The course examines the societal and geographical implications of new technologies, including digitalization, big data, artificial intelligence (AI), and the Internet of Things. Students address the economic and financial geographies of technological innovation and analyze techno-economic trends emerging from: the growth of personal data; the deployment of machine learning and AI; and the expansion of surveillance / platform capitalism. Format: blended/online (if blended, then students should expect to spend 2 hours online and 1 hour in class)	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Processing and Analysis of Earth Observation	Faculty of Environmental & Urban Change	GEOG	4440	3	Sophisticated methods and techniques for collecting, processing and analyzing remote sensing data are examined. Special topics include image enhancement techniques (e.g. texture transforms), non-traditional image classification and data integration for incorporation of remote sensing data products into geographic information systems (GIS). Prerequisite: AP/GEOG 3440 3.00 or ES/ENVS 3521 3.00 or LE/EATS 4220 3.00 or written permission of the Instructor. Course credit exclusions: ES/ENVS 4521 3.00 (prior to Fall 2013). Previously offered as: AP/GEOG 4440 3.00, SC/GEOG 4440 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Strategies for Wealth Creation in the Metals & Minerals Industry	Schulich School of Business	GMMM	6100	3	Provides an understanding of the challenges and opportunities of the global mining industry. Students evaluate and apply a strategy framework to mining companies which focuses on creating value for all stakeholders in a sustainable manner. Prerequisites: All 5000 series Core Foundation Courses and SB/GMMM 5100 1.50 Corequisites: SB/GMMM 6200 3.00, SB/GMMM 6300 3.00, SB/GMMM 6400 3.00	en	SDG 9 Industry, Innovation and Infrastructure		
Metals and Minerals in the Global Economy	Schulich School of Business	GMMM	5100	1.5	This course provides students with an understanding of the metals and minerals industry and its impact on the global economy. We examine the mining life cycle and the defining characteristics of the metals and minerals industry which address all aspects related to the discovery and production of metals and minerals. We also explore the materials life cycle which starts with metals as the raw materials for industries that produce products that are vital to society. We then explore the relationships between companies that produce metals and those that consume metals.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Organizational Excellence in the Metals and Minerals Industry	Schulich School of Business	GMMM	6400	3	Students learn to develop Organizational Excellence Models and how to implement the strategic choices of metals and minerals companies. This includes the identification, development, and measurement of elements of Organizational Excellence in the metals and minerals industry as well as the creation of supporting organizational structures and governance mechanisms. Prerequisites: All 5000 series Core Foundation Courses and SB/GMMM 5100 1.50 Corequisites: SB/GMMM 6100 3.00, SB/GMMM 6200 3.00, SB/GMMM 6300 3.00	en	SDG 9 Industry, Innovation and Infrastructure		

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How to Think About Technology: Hacking the History of Machines	Faculty of Liberal Arts & Professional Studies	HIST	2820	3	This course asks how we should think about technology. Focusing on one of the most complex and powerful categories for organizing our world, it explores how our relationship with technology has always been about more than material objects: it has been a way to define, dismantle, and reshape our relationships to nature, knowledge, society, the past and the future. NOTE: This course fulfills 3.00 credits of International Development Studies for Lassonde concentration requirement.	en	SDG 9 Industry, Innovation and Infrastructure		
Health Data Analytics, Machine Learning and AI	Faculty of Health	HLST	3350	3	Provides a practical introduction to Health Data analytics to students from multiple disciplines. It permits students to understand data analytics including descriptive, predictive and prescriptive analytics, machine learning, artificial intelligence and the different tools that can be deployed to implement health data analytics. Students would be able to understand how and when healthcare analytics can be used to make better decisions; they will also be able to identify the opportunities and the challenges that analytics present to health and society. Prerequisite: HH/HLST 2300 6.00	en	SDG 9 Industry, Innovation and Infrastructure		
The Global Circulation of Knowledge	Faculty of Liberal Arts & Professional Studies	HUMA	4157	3	How is scientific knowledge and its associated technologies transformed as they cross cultural boundaries? This course analyzes scientific theories, objects, and technologies in circulation, as they move from their point of origin to locations around the world. It will draw on recent scholarship on the global history of science, science and translation studies, and the impact of colonialism.	en	SDG 9 Industry, Innovation and Infrastructure		
Dangerous Visions, Brave New Worlds: The Science Fiction Culture and Our Scientific Age	Faculty of Liberal Arts & Professional Studies	HUMA	1905	9	Explores how the medium of science fiction has given cultural expression to changing attitudes towards modern science and technology. Topics include science fiction and the computer, relativity and quantum theory, religious belief, genetics and potential apocalypses.	en	SDG 9 Industry, Innovation and Infrastructure		
Knowledge, Technology and Culture	Faculty of Liberal Arts & Professional Studies	HUMA	2920	6	Explores technologies of knowledge in social and cultural context, examining histories of classification, ethical and political concerns about information, debates over artificial intelligence and artificial life, and the social impact of technologies like the book, telegraph and computer. Previously offered as: AP/HUMA 2920 9.00.	en	SDG 9 Industry, Innovation and Infrastructure		
International Business Simulation	Schulich School of Business	INTL	4300	3	Student teams use a sophisticated business simulation program to manage a firm through multiple years of operation in a competitive industry. All teams must integrate their knowledge of functional areas of business and ethics to develop a mission and strategy for their firm and implement the strategy in a dynamic market and consistently revise their strategy in response to the strategic moves of competing firms. At the same time, students must analyze and reflect upon the dynamics of expanding their operations to successfully compete in an international market. Prerequisites: SB/SGMT 3000 3.00 or INTL 3000 3.00 (previously offered as SB/INTL 4400 3.00) Not open to exchange students.	en	SDG 9 Industry, Innovation and Infrastructure		

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Introduction to Information Technologies	Faculty of Liberal Arts & Professional Studies	ITEC	1000	3	Introduces basic concepts of contemporary information technologies (computers, networks, telecommunications) used to process and store information in organizations. The course material includes both hardware and software components, which students compare, select and combine to solve information problems. NCR: students who have successfully completed or who are currently enrolled in any computer science course at the 2000-level or higher. Course credit exclusion: GL/ITEC 1011 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Information and Organizations	Faculty of Liberal Arts & Professional Studies	ITEC	1010	3	The value and importance of information to organizations, how it is used, stored and processed; emphasizes the uses of information technologies of various kinds, the benefits of the technologies, and the associated costs and problems; use of desktop applications. Course credit exclusion: GL/ITEC 1010 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Introduction to Computer Programming	Faculty of Liberal Arts & Professional Studies	ITEC	1610	3	This is a first course on computer programming using Python. It introduces elementary data, lists, sets, tuples and dictionaries. It also introduces the Python program structure control flow, functions, classes, objects and methods. This course uses simple examples to facilitate the understanding of the programming language.	en	SDG 9 Industry, Innovation and Infrastructure		
Introduction to Analytical Programming	Faculty of Liberal Arts & Professional Studies	ITEC	2600	3	The course presents an extension of structured programming concepts covered in ITEC1620. Students are introduced to new programming environments (e.g., MATLAB) for industrial applications and develop skills in technical computing, data visualization and simulation. Prerequisite: AP/ITEC 1620 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Web Technologies	Faculty of Liberal Arts & Professional Studies	ITEC	3020	3	Web technology is the amalgamation of Web related software and systems. This course covers some programming topics such as CGI, Java and JavaScript and some fundamental topics such as data markup, networking, security and text processing. Prerequisites: AP/ITEC 1000 3.00, AP/ITEC 1010 3.00, AP/ITEC 1620 3.00, AP/ITEC 2610 3.00, AP/ITEC 2620 3.00, SC/MATH 1190 3.00, SC/MATH 2320 3.00, SC/MATH 2565 3.00.PRIOR TO FALL 2014: Course credit exclusion: LE/CSE 2041 3.00.PRIOR TO SUMMER 2013: Prerequisites: AP/ITEC 2610 3.00 and general prerequisites. Course credit exclusion: SC/CSE 2041 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Applied Data Communications and Networks	Faculty of Liberal Arts & Professional Studies	ITEC	3210	3	Communications systems, environments and components; choices for data, voice and imagery; network control, design and management; distributed and local networks; client/server and Intranet technologies; Web-based technologies. Prerequisites: AP/ITEC 1000 3.00, AP/ITEC 1010 3.00, AP/ITEC 1620 3.00, AP/ITEC 2610 3.00, AP/ITEC 2620 3.00, SC/MATH 1190 3.00, SC/MATH 2320 3.00, SC/MATH 2565 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		

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Information Technology Risk Management	Faculty of Liberal Arts & Professional Studies	ITEC	3500	3	<p>This course covers key IT risk components and ways to mitigate those risks. Areas of instruction include how to manage IT-related risks addressed by CobiT, ITIL and ISO 17799 standards. Prerequisites: AP/ITEC 1000 3.00, AP/ITEC 1010 3.0, AP/ITEC 1620 3.00, AP/ITEC 2610 3.00, AP/ITEC 2620 3.00, SC/MATH 1190 3.00, SC/MATH 2320 3.00, SC/MATH 2565 3.00.PRIOR TO FALL 2014: Prerequisites: AP/ITEC 2610 3.00, AP/ITEC 3010 3.00.</p>	en	SDG 9 Industry, Innovation and Infrastructure		
Information Technology Project Management	Faculty of Liberal Arts & Professional Studies	ITEC	3505	3	<p>This course is uniquely suited to the needs of IT professionals entering the corporate world as effective project managers or project team members. It examines all aspects of IT projects including hardware, software, methodologies, and vendor relationships and presents core concepts, skills, tools, and techniques needed to develop information systems on time, within budget and to specification. Prerequisites: AP/ITEC 1000 3.00, AP/ITEC 1010 3.00, AP/ITEC 1620 3.00, AP/ITEC 2610 3.00, AP/ITEC 2620 3.00, SC/MATH 1190 3.00, SC/MATH 2320 3.00, SC/MATH 2565 3.00. Course credit exclusion: AP/ADMS 3353 3.00. PRIOR TO FALL 2014: Prerequisites: General Prerequisites for all 3000-level (except for AP/ITEC 3010 3.00) or above courses. Students must have successfully completed all 1000- and 2000- level required courses in information technology and mathematics required for their program option and AP/ITEC 3010 3.00 before taking courses in information technology at the 3000- or 4000- level including earning a minimum grade of C in either AP/ITEC 2610 3.00 or AP/ITEC 3010 3.00. Course credit exclusion: AP/ADMS 3353 3.00.</p>	en	SDG 9 Industry, Innovation and Infrastructure		
Applied Artificial Intelligence	Faculty of Liberal Arts & Professional Studies	ITEC	4310	3	<p>A brief survey to the theory and development of artificial intelligence (AI) leading to current models of application and deployment. Full hands-on training with one example of a commercial AI service platform. A large project assignment will provide course participants with an opportunity to build an AI-based application. Prerequisites: ITEC 3040 3.00 Open to: IEP students, other students who meet pre-requisites</p>	en	SDG 9 Industry, Innovation and Infrastructure		
Information Systems Strategy, Management and Innovation	Faculty of Liberal Arts & Professional Studies	ITEC	4070	3	<p>This course explores the issues and approaches in managing the information technology and information systems function in organizations and how the IT/IS function integrates, supports and enables various types of organizational capabilities. Digital technologies are now at the core of business transformation and require IT leaders to become strategic business partners ensuring alignment of IT strategy and business objectives.PREREQUISITES: AP/ITEC 3010 - Systems Analysis and Design I (3.00)</p>	en	SDG 9 Industry, Innovation and Infrastructure		

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Advanced Information Retrieval Systems	Faculty of Graduate Studies	ITEC	6210	3	Introduces advanced techniques and core technologies used in information retrieval and studies the theory, design, and implementation of text-based information retrieval systems. Focuses on effectively interpreting imprecise queries and providing a high quality response to them from large text-based collections. Prerequisite: AP/ITEC 4020 3.00 or equivalent.	en	SDG 9 Industry, Innovation and Infrastructure		
Instrumentation, Signal Processing, and Modelling in Biophysical Research	Faculty of Graduate Studies	KAHS	6170	3	Techniques in data acquisition, reduction, modelling, and signal processing commonly employed in biophysical research are discussed in class and used in laboratory sessions. Students will become familiar with the use of many transducers and their systems characteristics, electromyography, analog-to-digital conversion, documentation of motion, signal-to-noise enhancement, stress-strain, models, and tissue mechanics.	en	SDG 9 Industry, Innovation and Infrastructure		
Linear Algebra I	Glendon College	MATH	1660	3	This is a basic mathematics course as well as a very useful course for someone who wishes to do applied research in the social sciences. Among the topics considered are vectors, bases, matrices, systems of linear equations, rank and determinants. Some applications of linear algebra to various other disciplines, such as economics, are also included. Course credit exclusions: SC/MATH 1021 3.00, SC/MATH 2221 3.00, GL/MATH 2650 3.00, GL/MODR 2650 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Data analytics: A Hands-on Approach	Faculty of Science	MATH	3333	3	This is an applied statistics course for all math or science major students. The aim is to provide an application oriented training on data analytics in industrial or business setting. The course will cover a wide selection of data analytic techniques to equip students with appropriate computing skills and required statistical methodologies to conduct machine learning and data mining. The lectures will cover various methodologies and algorithms; as well as teach students to use data analytics related software (R or others) to solve real life problems. The students are expected to analyze data with the proposed software. Prerequisites: SC/MATH 1131 or equivalent; LE/ECS 1560 or LE/EESC 1541 or equivalent.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 4 Quality Education	
Linear Optimization	Faculty of Science	MATH	3171	3	Introduces students to linear optimization (linear programming), including the problem formulation, simplex method, LP-duality theory, sensitivity analysis, and its business and industrial applications. Prerequisites: SC/MATH 1021 3.00 or SC/MATH 1025 3.00 or SC/MATH 2221 3.00. Course credit exclusions: AP/ECON 3120 3.00, AP/ADMS 3331 3.00, AP/ADMS 3351 3.00, GL/MATH 3660 6.00, SC/MATH 3170 6.00 (prior to Winter 2016).	en	SDG 9 Industry, Innovation and Infrastructure		

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Combinatorial Optimization	Faculty of Science	MATH	3172	3	Introduces students to combinatorial optimization (integer programming), including problem formulation, branch-and-bound method, cutting-plane method, implicit enumeration, and its business and industrial applications, including transportation problem, network flow optimization etc. Prerequisites: SC/MATH 3171 3.00, SC/MATH 1021 3.00 or SC/MATH 1025 3.00 or SC/MATH 2221 3.00. Course credit exclusions: AP/ECON 3120 3.00, AP/ADMS 3331 3.00, AP/ADMS 3351 3.00, GL/MATH 3660 6.00, SC/MATH 3170 6.00 (prior to Winter 2016).	en	SDG 9 Industry, Innovation and Infrastructure		
Realizing Value from AI and Analytics in Organizations	Schulich School of Business	MBAN	6200	3	This course provides a practical grounding in analytics and artificial intelligence (AI) and its business applications in organizations. Students will learn how to address business pain points through AI and analytics solutions and how to sell and deliver project ideas. Students will gain skills needed to transform an organization into an innovative, efficient and data driven company of the future.	en	SDG 9 Industry, Innovation and Infrastructure		
Artificial Intelligence in Business I	Schulich School of Business	MBAN	6500	3	Students are introduced to the field of artificial intelligence, with a focus on business applications and a historical perspective that covers the basic terminology and concepts. The course covers multiple facets of artificial intelligence including knowledge representation and symbolic reasoning; biologically inspired approaches to artificial intelligence; supervised, unsupervised, and reinforcement learning; multi-agent systems; planning; and natural language processing.	en	SDG 9 Industry, Innovation and Infrastructure		
Analytics Consulting Project	Schulich School of Business	MBAN	6090	6	The Analytics Consulting Project is the capstone integrative course of the MBAN program. It will allow students to deepen their understanding of the subject matter and methodologies, as well as provide an opportunity for hands-on, problem-driven research and application. It is an intensive, 8 month project where groups of 4 MBAN students undertake a comprehensive analytics project of an organization ("client site") and provide business insights to enhance the site's future success. At the conclusion of the analytics consulting project students submit and present their final work to a panel of at least two experts, including the course director, and also to the client site.	en	SDG 9 Industry, Innovation and Infrastructure		
Microfluidics and Nanofluidics	Faculty of Graduate Studies	MECH	6101	3	Topics include: Low Reynolds number fluid dynamics; liquid and gas flows; surface tension, wetting and capillarity; thermal effects; lubrication theory; experimental methods; biofunctionalization; fabrication techniques; fluids in nanochannels.	en	SDG 9 Industry, Innovation and Infrastructure		
Advanced Optical Measurement Techniques for Engineering	Faculty of Graduate Studies	MECH	6505	3	Topics include image processing and analysis with MATLAB, Python and OpenCV; theory and operation of cameras; particle image velocimetry, digital image correlation, tomographic imaging techniques. Prerequisite: Consent of the Instructor	en	SDG 9 Industry, Innovation and Infrastructure		

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Advanced Fluid Dynamics	Faculty of Graduate Studies	MECH	6105	3	This is a first graduate level course in fluid dynamics with an introduction to turbulent flow and modeling. This course builds from an assumed undergraduate knowledge of fluid mechanics. The course begins with review of tensor notation, flow kinematics and derivation of the equations of fluid motion. Following this, the course covers exact solutions to Navier-Stokes equations, circulation and vorticity, potential flow, boundary layers, turbulence, modeling and closure methods. Prerequisite: undergraduate level fluid mechanics.	en	SDG 9 Industry, Innovation and Infrastructure		
The Finite Element Method in Engineering Analysis	Faculty of Graduate Studies	MECH	6301	3	Topics include: variational formulations and approximation for continuous systems; stiffness matrix formulations of truss and beam elements; 2D & 3D isoparametric finite elements; shell elements; FEA static analysis; steady state thermal analysis (conduction only); mass matrix formulations; vibration eigen value problems; dynamic (time domain) problems; linear solvers; verification and validation in finite element procedures. Prerequisites: LE/MECH 3502 3.00, SC/MATH 2270 3.00, LE/EECS 1021 3.00 and/or by Instructor's permission.	en	SDG 9 Industry, Innovation and Infrastructure		
Multidisciplinary System Design Optimization for Mechanical Engineers	Faculty of Graduate Studies	MECH	6302	3	This course covers Multidisciplinary Design Optimization Methods and its applications in the field of engineering. To create advanced and complex engineering systems that are competitive (both in performance and life-cycle value), today's engineers need a rigorous, quantitative multidisciplinary design methodology that can integrate with the intuitive non-quantitative and creative side of the design process. Topics covered include: unconstrained and constrained gradient-based optimization; Gradient-free optimization, various optimization techniques such as sequential quadratic programming, simulated annealing or genetic algorithms and machine learning algorithms such as Supervised Learning, Unsupervised Learning, or Reinforcement Learning. Pre-requisites: Consent of the Instructor.	en	SDG 9 Industry, Innovation and Infrastructure		
Technology Commercialization	Faculty of Graduate Studies	MECH	6502	3	Market adoption of new technologies is of concern to researchers, interested in creating economic value from their research, and attracting research. However, technology utility, by itself, is not sufficient to achieve commercial success. This course helps technologists understand the complex issues around enhancing the value proposition of novel technologies, and overcoming barriers to adoption through strategic partnerships or venture creation.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	

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Disruptive & Exponential Technology Innovations	Faculty of Graduate Studies	MECH	6503	3	Concepts in Disruptive and Exponential Technologies; impact on industries and society; broad overview of disruptive technologies including 3D Printing, drones, robotics, automation, sensors, AI, Big Data, Genomics Sequencing, nanotechnology, advanced materials, microfluidics, energy and sustainability and IoT. Incorporating several technologies into a tech project proposal able to disrupt an established industry and ultimately developing a foundational understanding of technology entrepreneurship opportunities. Pre-requisites: Consent of the Instructor.	en	SDG 9 Industry, Innovation and Infrastructure		
Engineering Graphics & CAD Modeling	Lassonde School of Engineering	MECH	2401	3	This course discusses technical drawing principles, introduction and application of computer aided design tools, and solid modeling. Simple model parts, which can be assembled together, are fabricated in teams (e.g., using additive technology). Prerequisite: LE/ENG 1102 4.00. Cross-listed: LE/ESSE 2401 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Mini Design Project 1	Lassonde School of Engineering	MECH	2412	3	The course consists of two main modules. The first module covers workshop safety, and introduces and practices of various subtractive manufacturing methods (e.g., cutting, drilling, machining). The second module includes a review of the design process, project planning techniques, and effective project and team management skills. The student will work in teams and will apply the fundamental concepts of the design process through completing a mini design project. Course credit exclusions: LE/MECH 2402 2.00, LE/MECH 2501 2.00. Prerequisites: LE/ENG 1102 4.00, LE/MECH 2401 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Heat Transfer	Lassonde School of Engineering	MECH	3203	3	This course will develop students' understanding and problem solving skills in topics of heat transfer, including: Steady and unsteady heat conduction (exact and numerical analysis); free and forced convection (internal and external); heat exchangers; thermal radiation; heat transfer with phase change. Students will extend their knowledge previously learnt in Heat and Flow Engineering Principles and Fluid Mechanics to solve engineering problems. Prerequisite: LE/MECH 3202 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Mechanisms for Mechanical Systems	Lassonde School of Engineering	MECH	3302	3	This course covers topics including classifications of mechanisms; velocity, acceleration and force analysis (e.g., for linkages, cranks, sliders, and cams); balancing of rotating and reciprocating machinery; gears and gear-trains; graphical and computer-oriented methods of analysis for mechanisms; applications of different mechanisms in mechanical systems (e.g., engines, manufacturing systems). Prerequisite: LE/MECH 2302 3.00. Course credit exclusion: LE/ESSE 3340 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		

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Macro-and-Micro Manufacturing Methods	Lassonde School of Engineering	MECH	3503	3	The ever-expanding range of scale in manufacturing presents unique challenges for engineers and manufacturers. This course will introduce students to the traditional macro-manufacturing methods and existing micro-manufacturing methods. Macro-manufacturing methods may include casting, forming and forging, machining (e.g. CNC and EDM), injection molding, additive manufacturing, treatments (heat, shot pinning, etc.). Micro-manufacturing methods will include those based on silicon, thin film and polymer technologies; Current trends and issues will be explored during selected field trips, laboratory visits, and/or through in-class activities. Prerequisite: LE/MECH 2301 3.00; LE/MECH 2412 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Aerodynamics	Lassonde School of Engineering	MECH	4202	3	This course is a first course specialized in aerodynamics. In this course the flow over aerofoils, wings, and bluff bodies are studied. Potential flow is used to develop the theory of flow over aerofoils and wings, using classical and numerical methods, such as thin-aerofoil theory, vortex panel methods, and lifting-line theory. Additional topics include compressible flows, supersonic aerofoils and aircraft performance. Prerequisite: LE/MECH 3201 3.00 and LE/MECH 3202 3.00	en	SDG 9 Industry, Innovation and Infrastructure		
Introduction to Composite Materials	Lassonde School of Engineering	MECH	4301	3	This course will cover the design, fabrication, and analysis, of composite polymer composites and nanocomposites. Topics include: Introduction to polymers and their composites. Processing technologies to fabricate polymer composites and nanocomposites, micro-mechanics of composite lamina, macro-mechanics of composite lamina, analysis of composite laminates (Classical Laminate Plate Theory), failure analysis of composite laminates, design of laminated structures, applications and research on polymer composites and nanocomposites. Prerequisites: SC/MATH 1025 3.00 and LE/MECH 3502 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
System Level Engineering	Lassonde School of Engineering	MECH	4401	3	This course discusses system level analysis methodology for complex engineering cases (quantitative and qualitative methods/frameworks), technology selection, technology integration, and life cycle analysis. Prerequisites: ES/ENVS 2150 3.00 or LE/ESSE 2210 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Advanced Mechanical Technologies	Lassonde School of Engineering	MECH	4510	3	This course discusses non-traditional and interdisciplinary areas that mechanical engineers work for as well as analysis of assumptions, governing laws, behavior, and forces for a set of non-traditional systems (e.g. micro-fluidic systems, MEMS, electro-chemical-mechanical systems, biomedical devices, biological systems, etc.). Prerequisites: SC/MATH 2015 3.00, LE/MECH 2202 3.00, and LE/MECH 3503 3.00	en	SDG 9 Industry, Innovation and Infrastructure		

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Integrative Business Simulation	Schulich School of Business	MGMT	4100	3	In this core course, student teams use a sophisticated business simulation program to manage a firm through multiple years of operation in a competitive industry. All teams must integrate their knowledge of functional areas of business and ethics to develop a mission and strategy for their firm, implement the strategy in a dynamic market and consistently revise their strategy in response to the strategic moves of competing firms. Note: Not available to exchange students visiting Schulich. Prerequisites: SB/SGMT 3000 3.0 or SB/INTL 3000 3.0 (Previously offered as SB/INTL 4400 3.00).	en	SDG 9 Industry, Innovation and Infrastructure		
Creativity & Innovation: Techniques for a Rapidly Changing World	Schulich School of Business	MGMT	6810	3	Creativity and innovation are essential leadership skills in the ever-changing environment. This applied-learning course arms MBA graduates with the right mix of creativity-enhancing tools and techniques to explore innovation in contemporary business contexts. These techniques include lenses of human understanding, creativity, visual thinking and holistic visioning. Bridging a necessary gap, the outcomes are applied to practical business issues. Prerequisite: All 5100-series Required Foundations of Management Core Courses.	en	SDG 9 Industry, Innovation and Infrastructure		
Innovation through Technology and Design	Schulich School of Business	MGMT	6800	3	Managing innovation, technology and design is key to success. This cross-functional course provides students with understanding and hands-on "innovation lab" experience applying the latest thinking in technology and design to innovation strategies. Suitable for all students, the course emphasizes the balancing of 21st century management skills of creativity, rigor and intuition in the end-to-end management of customer experience.	en	SDG 9 Industry, Innovation and Infrastructure		
Marketing Research	Schulich School of Business	MKTG	3100	3	This course develops a managerial appreciation of marketing research. The steps of the research project are delineated, from problem definition through research design, sample selection, data collection, analysis and presentation. The concepts discussed are integrated into the broader requirements of a marketing information system. A major term project is required. Prerequisite: SB/MKTG 1030 3.00 (Previously offered as SB/MKTG 2030 3.00).	en	SDG 9 Industry, Innovation and Infrastructure		
Retail Marketing Strategies	Schulich School of Business	MKTG	4250	3	Retailing is a cornerstone of marketing because it brings together the two most important players in business-buyers and sellers. In this course the student will learn and apply such topics as category management, service quality, customer satisfaction, relationship marketing, and retention marketing to solve problems confronted by marketers in this rapidly evolving industry. Prerequisite: SB/MKTG 1030 3.00 (previously offered as SB/MKTG 2030 3.00)	en	SDG 9 Industry, Innovation and Infrastructure		

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Tourism, Sport & Leisure Marketing	Schulich School of Business	MKTG	4320	3	Explores the tourism-sports-leisure (TSL) industry, one of the fastest growing sectors of the economy. Students will learn about unique strategic challenges of TSL marketing. In addition, expertise of the cultural, societal, and technological context of TSL production and consumption will be discussed to prepare students for jobs in this complex and competitive marketplace. Prerequisite: SB/MKTG 1030 3.00 (Previously offered as SB/MKTG 2030 3.00).	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Marketing Research	Schulich School of Business	MKTG	6050	3	This course develops students' understanding of basic and advanced market research methods. Students learn to evaluate completed research projects and conduct research studies, developing proficiency in defining research questions, developing research designs, selecting appropriate samples, conducting analysis and writing actionable management reports. Also examined are mobile research, brand maps, social media monitoring/metrics, Big Data, consumer surveillance and data privacy issues. Prerequisite: SB/MKTG 5200 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Consumer Insights	Schulich School of Business	MKTG	6140	3	Anticipating consumer response is at the heart of marketing strategy. Consumer theory provides a broad framework for effectively designing marketing research that speaks to strategy, as well as identifying key consumer insights in data interpretation. This course examines contemporary theories and research concerning common forms of consumer behaviour, and uses these concepts to provide practical insights into all aspects of the marketing mix. The topics relate to many different elements of the consumer behaviour process, including: perception, motivation, memory, self-concept, attitude judgment, choice, post-purchase responses, and consumer culture. Measurement, testing, and interpretation of consumer responses are emphasized throughout.	en	SDG 9 Industry, Innovation and Infrastructure		
Quantitative Methods for Business and Management Research	Faculty of Graduate Studies	MSMG	6010	3	This course prepares our students with the core knowledge and skills for designing quantitative, academic and applied, research in business and management, including understanding of data analysis and applications of statistical concepts and methods.	en	SDG 9 Industry, Innovation and Infrastructure		
Research Design and Qualitative Methods	Faculty of Graduate Studies	MSMG	6020	3	Students gain an understanding of the fundamentals of research design including consideration of the trade-offs among various strategies. Students develop their critical skills in evaluating the quality of qualitative research and appreciating the role of the reader in interpreting, translating and applying qualitative research.	en	SDG 9 Industry, Innovation and Infrastructure		
Fundamentals of Supply Chain Management	Faculty of Graduate Studies	MSMG	6550	3	Provides an in-depth study of the theory and practice of the SCM functions in the manufacturing and service industries and facilitates an understanding of the strategic concepts and tools necessary for meeting the challenges of 21st century supply chain management.	en	SDG 9 Industry, Innovation and Infrastructure		

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Marketing Analytics	Faculty of Graduate Studies	MSMG	6410	3	This course examines how marketing analytics transforms research information into strategic insights and how those insights are leveraged to inform marketing decision-making.	en	SDG 9 Industry, Innovation and Infrastructure		
Supply Chain Risk Management	Faculty of Graduate Studies	MSMG	6560	3	This course explores risks which would impede supply chain operations and managements in private sectors. This course also explores the potential applicability of concepts in private sector logistics to logistics of nonprofit sectors under disaster and emergencies. The course focusses on developing quantitative and qualitative models in supply chain risk management.	en	SDG 9 Industry, Innovation and Infrastructure		
Design and Management of Organizational Processes	Schulich School of Business	MSTM	5210	3	This course involves a critical examination of the most important ideas and practices used by organizations to design and implement competitive processes. This includes six sigma lean, supply chain management, project management and the adoption of new technology. This also involves consideration of the role of customers, employees and suppliers. The goal is safer, greener, more cost effective and better quality products and services.	en	SDG 9 Industry, Innovation and Infrastructure		
Music in the City	School of Arts, Media, Performance & Design	MUSI	1900	3	Explores the conception, production, distribution, performance, and reception of a wide variety of musical practices, including jazz, popular, western classical, and world musics. Through readings, listening examples, field trips, lectures and interviews, issues such as identity, community, diaspora, politics, industry, hybridity, technology and globalization will emerge. Theoretical work is grounded in case studies of particular performance practices, musicians, and venues in Toronto. Not open to music majors. Open to non-majors.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 16 Peace, Justice and Strong Institutions	
Popular Music in the Era of Rock	School of Arts, Media, Performance & Design	MUSI	3500	3	Examines popular music and culture from the 1950s to the 1990s, surveying social and musical preconditions for the rise of Rock and Roll. Issues considered include social/political contexts; meaning to consumers and creators; relationship with technology and mass media; musical styles and forms. Prerequisites: FA/MUSI 1000 6.00, FA/MUSI 1200 9.00, FA/MUSI 2000 6.00 and FA/MUSI 2200 6.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Science of Space Flight and Exploration	Faculty of Science	NATS	1530	3	This course will look from a historical timeline at the science and technology of space flight and the discoveries and expansion of our knowledge through space exploration. NCR note: This course is not open to any student enrolled in Lassonde's Earth and Space Science and Engineering program (ESSE).	en	SDG 9 Industry, Innovation and Infrastructure		
Physics and Technology for Future World Leaders	Faculty of Science	NATS	1945	6	This course presents the most interesting and important topics in physics, stressing conceptual understanding rather than emphasizing the math, and with applications to current events and technologies. No prior knowledge of physics is required.	en	SDG 9 Industry, Innovation and Infrastructure		

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The Nature of Time	Faculty of Science	NATS	1795	6	The concept of time has intrigued thinkers from all ages. The impact of measuring and marking time intervals on the development of human culture, and our understanding of the world around us, cannot be understated. The drive to measure and understand time led ancient peoples to a very sophisticated knowledge of the sky; from that knowledge emerged accurate calendars, as well as mathematics itself. We will look at how changing concepts of time and the technological accuracy of measuring time drove fundamental changes in physics, and deepened our understanding of the world around us. The first half of the course covers timekeeping methods, including the sky as a clock, mechanical clocks, and quartz and atomic clocks. The second half of the course focuses on modern issues of time including time perception, Einstein's revolutionary discoveries on the relative nature of time, and cosmic time. NCR Note: This course is not open to any student who has passed or is taking SC/PHYS 1010 6.00, SC/PHYS 1410 6.00, SC/PHYS 1420 6.00, SC/PHYS 1011 3.00, SC/PHYS1012 3.00, SC/PHYS1411 3.00, SC/PHYS1412 3.00, SC/PHYS 1421 3.00, SC/PHYS1422 3.00	en	SDG 9 Industry, Innovation and Infrastructure		
Sun, Space Weather and Life on Earth	Faculty of Science	NATS	1580	3	Space Weather refers to variations of near-Earth space conditions originating in Solar activity which could potentially cause damage to astronauts, critical technology and infrastructure. Modern society should be prepared for extreme Space Weather events.	en	SDG 9 Industry, Innovation and Infrastructure		
Light and Sound	Faculty of Science	NATS	1720	6	How light and sound waves travel and transfer energy. Topics will include: sound waves and musical instruments; light waves and stars; technologies such as lasers and CDs; rainbows and mirages. Course credit exclusions: SC/NATS 1520 3.00, SC/NATS 1870 6.00. NCR note: This course is not open to any student enrolled in a Physics program.	en	SDG 9 Industry, Innovation and Infrastructure		

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Astronomy: Exploring the Universe	Faculty of Science	NATS	1585	3	<p>Explores the universe beyond our solar system. We begin by studying how gravity triggers fusion reactions in stars that create heat, light, and every element in our bodies except hydrogen: overall, stars shine by converting mass into energy (Einstein's $E=mc^2$). We discuss how we can use the corpses of stars (white dwarfs, neutron stars, and black holes) to probe how space and time are related via Einstein's theories of relativity. We examine how stars are bound together into galaxies by gravity and how to use various wavelengths of light to determine why there are different types of galaxies: elegant spirals, massive ellipticals, and faint dwarf galaxies. We learn how the Doppler effect reveals that dark matter must produce some of the gravity that binds stars into galaxies, galaxies into clusters of galaxies, and clusters of galaxies into superclusters. We explore how we can use distant galaxies to study the development of the universe over its entire history, including the increasing importance of dark energy. We confront both the earliest instants and the far future of our universe's history: what we know, what we still hope to learn, and what we think we can ever learn. Finally, we join some modern scientists in the speculation about whether or not other universes might exist beyond the one we can perceive. Course credit exclusions: SC/NATS 1740 6.00. NCR: to any student who has successfully taken or is taking SC/PHYS 1070 3.00 or SC/PHYS 1470 3.00. Not open to any student enrolled in the Astronomy stream. Minimal simple arithmetical calculation at about the Grade 10 level.</p>	<p style="text-align: center;">SDG 9 Industry, Innovation and Infrastructure</p>		
Technology and Civilization	Faculty of Science	NATS	1775	6	<p>A study of the most important technological advances in the context of various civilizations throughout history. Selected important innovations (e.g. mechanized agriculture, wind, water, steam and nuclear power generation, aviation and railways and communications).</p>	<p style="text-align: center;">SDG 9 Industry, Innovation and Infrastructure</p>	<p style="text-align: center;">SDG 7 Affordable and Clean Energy</p>	
Science, Technology and Society	Faculty of Science	NATS	1760	6	<p>A study of the intellectual and social nature of science and technology, their similarities and differences. The course may deal with the impact of scientific and technological advancements on societies both past and present. Course credit exclusions: SC/NATS 1765 6.00</p>	<p style="text-align: center;">SDG 9 Industry, Innovation and Infrastructure</p>		
Quantitative Methods	Schulich School of Business	OMIS	5120	1.5	<p>An introduction to the use of quantitative methods for business research, analysis, forecasting and optimization. The aim is to convey not only an understanding of methods, but also to give an appreciation of their use in addressing actual business problems, and to acquaint students with computer software necessary for implementing these methods.</p>	<p style="text-align: center;">SDG 9 Industry, Innovation and Infrastructure</p>		

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Operations Management	Schulich School of Business	OMIS	5210	1.5	Operations management in both manufacturing and service organizations involves the coordination of complex and dynamic systems of people, technology and materials to achieve competitive objectives. The impact of alternative strategies for delivering quality products in a cost-effective manner is examined. This includes currently popular inventory management philosophies such as 'Total Quality Management' and 'Just-In-Time' inventory management.	en	SDG 9 Industry, Innovation and Infrastructure		
Managing Change In Supply Chains	Schulich School of Business	OMIS	6300	1.5	Major changes to supply chains must align logistics, inventory management, purchasing, distribution, customer service and manufacturing by engaging critical stakeholders within and between organizations. This course takes a design for supply chain approach to all business cases for critical organizational initiatives. Best practices in managing teams and engaging all relevant stakeholders in a process of change are highlighted. Prerequisite: SB/OMIS 6200 3.00	en	SDG 9 Industry, Innovation and Infrastructure		
Introduction to Operations and Supply Chain Management	Schulich School of Business	OMIS	2010	3	This course introduces concepts, principles, and techniques that can be leveraged to analyze, control, and improve critical processes responsible for efficiently making and delivering goods and services. These critical processes reside in manufacturing and service, for-profit and non-profit organizations. Operational and supply chain challenges, as well as various conceptual aids and quantitative techniques to cope with these challenges, are discussed.	en	SDG 9 Industry, Innovation and Infrastructure		
Supply Chain Management	Schulich School of Business	OMIS	4560	3	Supply chain management (SCM) underlies the strategy and operations of all firms that manufacture or distribute products and services. The torrid pace of improvements in information technologies made SCM both possible and, along with their global reach, also more complicated. This course will provide students with an understanding of the choices and trade-offs involved in designing and operating supply chains domestically and globally.	en	SDG 9 Industry, Innovation and Infrastructure		
Models&Applications In Operational Res	Schulich School of Business	OMIS	6000	3	Provides a survey of selected topics in operational research (OR). Emphasis is placed on the practical application of OR tools rather than on the mathematical properties. Application areas include: financial planning and portfolio selection, production, priority planning and marketing. Topics include: linear programming and its applications; programming to achieve a set of goals or targets with applications in finance and production; capital budgeting and project selection; transportation and network models; and portfolio models. Prerequisites: SB/OMIS 5120 1.50 and SB/OMIS 5210 1.50 or permission of the Instructor.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	

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Transportation and Logistics Management	Schulich School of Business	OMIS	6210	3	This course examines the role of transportation in a logistical network and the necessary investment in transportation processes and infrastructure to control costs, manage risk and improve customer service. Benefit and cost analysis is done on alternative modes and strategies for securing on-time delivery. We introduce concepts, techniques and technology for improved routing, cost reduction and supply chain asset utilization. Prerequisites: SB/ACTG 5200 3.00 and SB/MSTM 5060 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Coordinating Demand and Supply	Schulich School of Business	OMIS	6230	3	This course introduces students to quantitative models for demand forecasting, aggregate planning, inventory control, and revenue management. The focus is on developing a basic understanding of how organizations in multi-echelon supply chains make data-driven decisions using sophisticated computational techniques. Topics include time series, machine learning, and mathematical optimization with applications to logistics, manufacturing, inventory coordination, contracting, customer segmentation, and pricing. Prerequisite: SB/MSTM 5060 3.00	en	SDG 9 Industry, Innovation and Infrastructure		
Supply Chain Management	Schulich School of Business	OMIS	6560	3	This course is about how to make decisions that lead to the better design and management of supply chains. This often involves changing the network of relationships between suppliers and customers and other stakeholders as they design, contract, order, plan and coordinate goods and services together. This course covers essential quantitative supply chain management models, supportive information and ecommerce technologies, environmentally and socially responsible practices and customer-supplier relationship management. Prerequisites: SB/OMIS 5110 1.50, SB/OMIS 5120 1.50, SB/OMIS 5210 1.50.	en	SDG 9 Industry, Innovation and Infrastructure		
Managing Data for Business Decisions	Schulich School of Business	OMIS	1050	3	Informed business decisions rely on data and technological support. This course introduces students to concepts of data, information, and technology to support business decisions. Topics discussed include data collection process; infrastructure of information systems; data understanding, summarization, and representation; hardware and software used to store and analyze data and to deploy data-driven solutions for modern business applications; and social and ethical issues surrounding data and IT security.	en	SDG 9 Industry, Innovation and Infrastructure		
Artificial Intelligence Fundamentals for Business	Schulich School of Business	OMIS	4010	3	This course addresses how to apply machine learning to managerial tasks. Students will learn how artificial intelligence is used for decision making. Specifically, students will develop technical skills revolving around business value discovery through data mining and apply it to tasks such as statistical learning, text mining, recommendation, outlier detection and social network analysis. Previous programming knowledge is expected. Prerequisites: SB/OMIS 2010 3.00 and SB/OMIS 2050 3.00 (Previously known as SB/MGMT 2050 3.00)	en	SDG 9 Industry, Innovation and Infrastructure		

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Managing Digital Supply Chain Technology	Schulich School of Business	OMIS	6320	3	This course provides frameworks to evaluate and plan the adoption and implementation of supply chain new technologies. This includes the assessment of the competitive limits of existing organizational systems, processes and relationships for doing supply chain tasks and supporting potentially new business models. We discuss the challenges and strategies for innovating to secure supply chains against risks such as climate change and technological disruption.	en	SDG 9 Industry, Innovation and Infrastructure		
Digital Transformation in Services	Schulich School of Business	OMIS	6610	3	Digital technologies are changing the way service organizations do business and interact with their customers. Students explore and learn the foundations of digital transformation and make the connection among strategy, technology, and implementation. The course will provide students with real-life business cases in which various trade-offs must be made according to the technology, the business strategy, and the service requirements.	en	SDG 9 Industry, Innovation and Infrastructure		
Crime in the Digital Age: Emerging Risks	Faculty of Graduate Studies	PCS	6168	3	This 3-credit course builds on the Crime in the Digital Age: An Overview course. It addresses our society's dependence upon, and the evolution of, networked communications that have changed computer crime dramatically. It focuses on three of the driving capabilities of digital innovations that have increased our risk at the hands of rogue individuals, groups, and states: autonomous agency, data manipulation, and the politicization of information. Detection and attribution have similarly grown in sophistication, and those technological advancements favour both civil society and those that seek to subvert it. Those innovations enable individuals to levy sophisticated attacks, conduct human trafficking, or threaten election results, at a scale formerly only available to organized crime rings or to rogue governments.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 11 Sustainable Cities and Communities	SDG 16 Peace, Justice and Strong Institutions
Privacy and Data Security from a Legal, Business and Technological Perspective	Faculty of Graduate Studies	PCS	6161	6	This course focuses on technological, business, economic, and legal perspectives relating to privacy and data security. The goal is to provide the student with a cross-disciplinary context in which to evaluate and consider current and emerging legal issues in relation to the privacy and cybersecurity, with a particular emphasis on the internet and new technologies.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 16 Peace, Justice and Strong Institutions	
Iranian Cinema: Aesthetics and Culture	Faculty of Liberal Arts & Professional Studies	PERS	2800	6	This course is designed to introduce students to Iranian cinema. Students study the aesthetics and the socio-cultural impact of Iranian films. The Iranian national film industry is critically analyzed from historical and comparative perspectives.	en	SDG 9 Industry, Innovation and Infrastructure		
Philosophy of Artificial Intelligence	Faculty of Liberal Arts & Professional Studies	PHIL	3750	3	An introduction to philosophical issues in Artificial Intelligence (AI). The goal is for students to be able to gain basic understanding of the cognitive architectures used by AI programmers, and reflect critically on research in AI from a philosophical perspective. Prerequisites: One of AP/PHIL 2160 3.00 or AP/PHIL 2240 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		

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Seminar in Philosophy of Science	Faculty of Liberal Arts & Professional Studies	PHIL	4110	3	An intensive examination of contemporary philosophical problems concerning the growth of science and technology selected from interpretations of theory, of models, of presumed facts, of presumed progress, of experimental technique, and of the place of values in science and technology. Prerequisite: At least nine credits in philosophy including one of AP/PHIL 2110 3.00, AP/PHIL 3170 3.00, AP/PHIL 3270 3.00, or AP/PHIL 3280 3.00. Course credit exclusions: None. PRIOR TO FALL 2009: Prerequisite: At least nine credits in philosophy, of which AK/PHIL 3280 3.00, AS/PHIL 3170 3.00, AS/PHIL 3270, or AS/PHIL 3280 3.00 is recommended. Course credit exclusion: AS/PHIL 4110 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Physics with Applications to Life Sciences	Glendon College	PHYS	1420	6	This course is a survey of physics in which many fundamental concepts are emphasized through applications to the life sciences. Topics include kinematics, dynamics, momentum and energy for linear and rotational motion; elementary kinetic theory and thermodynamics; static and current electricity; waves and physical and geometrical optics; and, elements of modern physics. Note: This is a calculus-based course. It includes a three-hour laboratory component, normally in alternating weeks. Prerequisites SPH4U, MHV4U, MHF4U. Course credit exclusions: SC/PHYS 1010 6.00, SC/PHYS 1410 6.00, SC/PHYS 1420 6.00, SC/PHYS 1800 3.00, SC/PHYS 1801 3.00, SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Physics Research	Faculty of Graduate Studies	PHYS	5400	3	A non-thesis experimental or theoretical research endeavour in physics, supervised by a faculty member. The student and supervising faculty member agree at the outset on the project scope (including required literature review), milestones (including frequency of regular student-faculty meetings), and deliverables (including a final written report).	en	SDG 9 Industry, Innovation and Infrastructure		
Astronomical Research	Faculty of Graduate Studies	PHYS	5490	3	A non-thesis experimental or theoretical research endeavour in astronomy, supervised by a faculty member. The student and supervising faculty member agree at the outset on the project scope (including required literature review), milestones (including frequency of regular student-faculty meetings), and deliverables (including a final written report).	en	SDG 9 Industry, Innovation and Infrastructure		
Introduction to Space Communications	Faculty of Science	PHYS	3250	3	The course covers all aspects of communications between spacecraft and ground stations. Topics include orbital aspects of satellite communications, communications components of satellites and interplanetary spacecraft and ground stations, transmission, reception, link equations, modulation, multiplexing techniques and access to a satellite. Prerequisite: SC/PHYS 2020 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Atomic and Molecular Physics	Faculty of Science	PHYS	4011	3	Application of quantum mechanics to atomic and molecular structure. One-electron systems, many electron atoms, Hartree-Fock approximation, fine structure, hyperfine structure, atom-laser interactions. Prerequisite: SC/PHYS 4010 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		

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Physics or Astronomy Project	Faculty of Science	PHYS	4310	3	A faculty-supervised research endeavour, either experimental or theoretical, in physics or astronomy. Before enrolling, the student and faculty member must agree upon the project scope, background reading, milestones including student-faculty meeting schedule, and deliverables including final written report.	en	SDG 9 Industry, Innovation and Infrastructure		
Politique en matière de science et de technologie	Faculty of Graduate Studies	PIA	6304	3	La science et la technologie influencent la société et l'économie comme jamais auparavant. Cette réalité n'est pas seulement nationale mais prend une dimension internationale de plus en plus importante. Elle a des répercussions majeures sur les stratégies gouvernementales, les organisations internationales et la diplomatie. Science and technology influence society and economy as never before. This reality is not only national but also international and impacts on governmental strategy, international organisations and diplomacy are profound.	fr	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	SDG 16 Peace, Justice and Strong Institutions
Strategic Management Seminar II	Schulich School of Business	PLCY	7020	3	This seminar builds upon SB/PLCY 7010 3.00 and examines theories and research from some of the newest and most provocative research streams that are beginning to be seen in strategic management. Both "content" and "process" streams are discussed and critiqued. (Offered in alternate years.)	en	SDG 9 Industry, Innovation and Infrastructure		
The Politics of Cyberspace	Faculty of Liberal Arts & Professional Studies	POLS	4071	3	As a component of the information revolution and globalization, cyber, in all of its manifesting forms - digital technology, internet, cyborg (cybernetic organism), social networks (Twitter, Facebook, Whatsapp, TiktTok), aesthetics, artificial life (AL), artificial intelligence (AI), algorithms, virtual reality, prosthetics, robotics - has since 1989 rapidly emerged as a feature of contemporary politics.	en	SDG 9 Industry, Innovation and Infrastructure		
States, Societies & Information Technology	Faculty of Liberal Arts & Professional Studies	POLS	4610	3	Offers a critical understanding of the dynamic between political power and information and communication technologies (ICTs). It discusses the role of information technologies in the formation and development of state power and in the development of civil society and its various communities and institutions. Of special concern is the tension between states and societies and the role of ICTs in that tension.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 11 Sustainable Cities and Communities	SDG 16 Peace, Justice and Strong Institutions

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Development Prototypes	Schulich School of Business	PROP	6200	3	This course deals with development, developers, and the products that they create. The course provides an understanding of the business of real estate development, insights into the economic, functional, technical, and aesthetic factors that shape dominant building forms, and an understanding of the link between demand and product development. Course content spans an understanding of the spatial economy of cities-where economic activity occurs and why-to the interaction between demand and supply in the marketplace, a detailed examination of the products that are shaped by market forces, and an overview of new prototypes that are emerging to meet emerging demands. The course is delivered through a combination of lectures, case studies, and guest speakers from industry. MBA Prerequisites: All 5000-series Required Foundations of Management Core Courses. MBA Corequisites: SB/PROP 6100 3.00 or permission of the Instructor.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Infrastructure Delivery Models	Schulich School of Business	PROP	6300	3	Infrastructure is an international business of increasing scope, complexity and scale that typically involves both the public and private sectors in various partnership arrangements. This course examines the many "moving parts" of this business and explores the various partnership models that are being employed to address a variety of social and economic infrastructure needs. MBA Prerequisites: All 5000-series Required Foundations of Management Core Courses Notes: Open to MREI students only.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 8 Decent Work and Economic Growth	
Advanced Seminar in Development	Glendon College	PSYC	4510	3	Major modern theories and research findings related to psychological development are reviewed in depth and opportunities provided for intensive study of topics of contemporary interest. Prerequisites: GL/PSYC 2510 6.00, GL/PSYC 3300 3.00 and either GL/PSYC 3310 3.00 or GL/PSYC 3510 3.00 and permission of the department. Course credit exclusion: HH/PSYC 4010 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Creativity	Faculty of Health	PSYC	3550	3	Offers a systematic study of the persons, processes and products of creativity, including theories, research and measurement methods. Creativity is defined as something that is both novel and significant. Prerequisite: HH/PSYC 1010 6.00, with a minimum grade of C.	en	SDG 9 Industry, Innovation and Infrastructure		

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Polymer Technology	Faculty of Science	SENE	3091	3	This subject correlates the structure, properties, applications, processing and fabrications of polymeric materials. Apart from traditional plastic materials, the most advanced plastics and composites used in aircraft, aerospace and automobile industries, body implants and optoelectronics will be discussed. The course includes the waste management, degradation and recycling of plastics for environment protection. The laboratory component emphasizes testing and processing. Not open to students having completed Seneca College course PTC633. Prerequisite: SC/CHEM 2021 3.00. Prerequisite or Corequisite: SC/SENE 3092 3.00 (or Seneca course CPM633). Course credit exclusion: SC/CHEM 3090 3.00.	en	SDG 9 Industry, Innovation and Infrastructure	SDG 12 Responsible Consumption and Production	
Techniques in Analytical Chemistry	Faculty of Science	SENE	2081	3	This is a one-semester, laboratory oriented subject, intended to introduce students to selected techniques of chemical analysis that are widely used in the industry: UV-Vis spectrophotometry, Classical column chromatography (normal phase), High Pressure Liquid Chromatography (reversed phase), Gas Chromatography. The theoretical lectures provide a basic understanding of the analytical procedures. The laboratory classes provide hands-on training for the analytical techniques presented in the theoretical course, and familiarize the student with the application of the respective techniques in a regulated industrial environment. To accomplish the above, the students must be able to combine their prior knowledge of chemistry and mathematics with the new terms and concepts taught in this course. Not open to students having completed SC/SENE 2082 3.00 or Seneca College courses TAC333 or TAC357. Prerequisites: SC/CHEM 1001 3.00 and SC/MATH 1014 3.00 (or Seneca courses CHM273 and MTH 273). Course Credit Exclusion: SC/CHEM 3080 4.0	en	SDG 9 Industry, Innovation and Infrastructure	SDG 4 Quality Education	
Logic of Social Inquiry: Qualitative Methods	Glendon College	SOCI	3680	3	An examination of how theories influence the logic of inquiry and research designs. Assumptions concerning objectivity and values are discussed and problems of operationalization are analyzed. Prerequisite: A course in Canadian studies or political science or sociology.	en	SDG 9 Industry, Innovation and Infrastructure		
Accelerating Technicity: 'Questions Concerning Technologies'	Faculty of Graduate Studies	SPTH	6155	3	Accelerating Technicity examines the concept of technology in select works of Heidegger, Marcuse, Deleuze, Simondon, Stiegler, Hayles, Virilio and Accelerationism. Using these theorists the course will grapple with Heidegger's two conflicting tendencies in technology: the dominant tendency of instrumental technology (the danger inherent in technology) and second, the tendency toward poesis (the revealing and saving potential inherent in technology). The course is presented in blended (BLEN) format that includes in-class, on-line and print EE components: seminar presentation, seminar participation, interactive on-line discussion forum, one minute film, plus paper abstract and essay. The aim is for the student to be able to interact proficiently and seamlessly both online and in person to meet the requirements of a networked world.	en	SDG 9 Industry, Innovation and Infrastructure		

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Introduction to Science and Technology Studies	Faculty of Graduate Studies	STS	5001	3	Introduces students to major texts and theoretical strands of science and technology studies through a combination of empirical case studies and theoretical reflections on themes central to science and technology studies scholarship, such as epistemology, objectivity, expertise and materiality.	en	SDG 9 Industry, Innovation and Infrastructure		
Introduction to Science and Technology Studies	Faculty of Graduate Studies	STS	6001	3	Introduces students to major texts and theoretical strands of science and technology studies through a combination of empirical case studies and theoretical reflections on themes central to science and technology studies scholarship, such as epistemology, objectivity, expertise and materiality.	en	SDG 9 Industry, Innovation and Infrastructure		
Critical Technology Studies	Faculty of Graduate Studies	STS	6203	3	This course provides students with an advanced and critical introduction to the social study of technology and technological innovation. The course explores how technologies are shaped by and come to social, cultural, political, and economic institutions, structures, and processes. The course is organized around a series of theoretical debates and empirical case studies of contemporary technological developments (e.g. Big Data, biotechnology, nanotechnology, cleantech, etc.).	en	SDG 9 Industry, Innovation and Infrastructure		
Science, Technology and Modern Warfare	Faculty of Science	STS	3730	3	Explores the interplay between warfare, scientific development, and technological change in a broad societal context through a series of representative case-studies from the past and the present. Enhances students' understanding of some of the main forces that shape our world. Course credit exclusion: SC/STS 3730 6.00.	en	SDG 9 Industry, Innovation and Infrastructure		
From the Abacus to Artificial Intelligence: how the computer came to be	Faculty of Science	STS	3561	3	Examines the evolution of computing and information technology in a broad social, cultural, and historical context, with special emphasis on developments since the early 20th century.	en	SDG 9 Industry, Innovation and Infrastructure		
Thinking with Things: Material Culture in Science and Technology Studies	Faculty of Science	STS	3400	3	Examines principles and techniques used in evaluating the material culture of science and technology to explore connections to ideas, practices, and values of a particular era. Students apply methods of analysis to understand material culture in context. Prerequisite: Completion of 24 credits.	en	SDG 9 Industry, Innovation and Infrastructure		
Science and Technology Issues in Global Development	Faculty of Science	STS	3790	3	Examines a multiplicity of historical and cultural factors influencing and shaping scientific norms and technological practices in global development. Moreover, this course seeks to address questions on how global development goals are affecting the utilization of planetary resources and the advancement of technological systems of production. One of the predominant objectives of this course is to elucidate the entanglements between science, technology and global development, and unpack further what "global development" means in the context of international cooperation and international security.	en	SDG 9 Industry, Innovation and Infrastructure		

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Technology, Experts and Society	Faculty of Science	STS	3726	3	A critical examination of the introduction and adoption of new technologies and the rise of expert knowledge. Specific historical examples of modern technologies will be considered in order to explore the relationship between society and technology.	en	SDG 9 Industry, Innovation and Infrastructure		
Perspectives on Contemporary Theatre	School of Arts, Media, Performance & Design	THEA	4200	3	Explores some of the innovative and challenging developments in dramatic writing and theatrical performance in the last 25 years, in Canada and internationally. Prerequisites: For theatre majors, FA/THEA 3200 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Documentation and Terminology	Glendon College	TRAN	2280	3	This blended course introduces future translators to research methods in documentation and terminology. Assignments focus on the development of critical and analytical thinking and on the practical application of these methods to translation projects. Course credit exclusions: GL/TRAN 3260 3.00, GL/TRAN 4370 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Translation of Specialized Texts Into English, Level I	Glendon College	TRAN	3210	3	Introduction to translation in a specialized area. Students acquire strategies for handling specialized translations from French to English. They increase and apply their knowledge of research tools and resources, learn techniques for resolving translation problems, and practice appropriate English usage. Prerequisite: GL/TRAN 2220 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Introduction to Translation into English II	Glendon College	TRAN	2220	3	Students build on their understanding of translation in specialized fields. They continue to acquire specialized translation strategies. They increase and apply their knowledge of research tools and resources, learn techniques for resolving translation problems, and practice appropriate English usage. Prerequisite: GL/TRAN 2210 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Documentation in Business and Industry	Glendon College	TRAN	4330	3	Students learn the requirements for online documentation from a theoretical and research perspective and develop project management skills. Prerequisite: GL/TRAN 4320 3.00. Note: Course open to students majoring in Translation and to students registered in the Certificate of Technical & Professional Writing.	en	SDG 9 Industry, Innovation and Infrastructure		
Advanced Ceramic Sculpture	School of Arts, Media, Performance & Design	VISA	3032	3	Explores the highly experimental and immediate process of modeling and firing clay to create sculpture. This course builds upon the information presented in Introduction to Ceramic Sculpture, with the goal of pushing the possibilities of the material, while developing personal research projects in clay. Prerequisite: FA/VISA 2037 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Modelling for 3D Fabrication	School of Arts, Media, Performance & Design	VISA	3033	3	Introduces students to the possibilities for creating digital objects using advanced 3D design software and 3D scanning technologies, and the related conceptual concerns. Prerequisite: three credits from FA/VISA 203x 3.00 series of courses; for DIGM students: FA/DATT 2050 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		
Digital Fabrication	School of Arts, Media, Performance & Design	VISA	3034	3	Introduces students to the possibilities for translating digital objects into physical objects using three-dimensional printing technologies, and the related conceptual concerns. Prerequisite: FA/DATT 3940 3.00 or FA/VISA 3033 3.00.	en	SDG 9 Industry, Innovation and Infrastructure		