



COURSE DESCRIPTIONS: W Booth School of Engineering Practice and Technology, McMaster University

Courses identified with an asterisk (*) are half courses. Courses identified with a pound (#) sign are quarter courses.

***6C03**

STATISTICS FOR ENGINEERS

(Same as Chemical Engineering *6C03)

Linear regression analysis in matrix form, non-linear regression, multiresponse estimation, design of experiments including factorial and optimal designs. Multivariate statistics. Special emphasis on methods appropriate to engineering problems.

[back to top](#)

***6AS3**

ADVANCED SYSTEM COMPONENTS AND INTEGRATION

This course covers network and data integration infrastructure of Industrial Internet of Things, including the integration of process/manufacturing automation, building automation, environment management, as well as energy management and electricity automation systems using DDE, OPC, and SCADA Systems. Moreover, the course covers other Industrial Internet of Things infrastructure components such as artificial intelligence based control systems as well as safety systems.

[back to top](#)

***6AT3**

CONCEPTUAL DESIGN OF ELECTRIC AND HYBRID ELECTRIC VEHICLES

Problem Based Learning course that allows group of students to design innovative electric or hybrid electric vehicle concepts and associated rental or car sharing services. Students are involved in topics that combine mechanical, electrical, controls, and computer engineering with business and management elements with the purpose of creating a smart vehicle associated with a smart car service.

[back to top](#)

***6DM3**

DATA MINING

Classification, association, prediction and clustering of data through the use of machine learning algorithms - from introductory approaches to recent advances. Evaluation metrics. Meta learning. Deep Learning.

[back to top](#)

***6E03**

ENTREPRENEURIAL OPPORTUNITY IDENTIFICATION

This introductory module will develop an understanding of the fundamentals of sustainable businesses by students exploring and evaluating their new business ideas and selecting an idea to pursue. Students will develop an awareness of, and skills in innovation and entrepreneurial behaviour. There will be a focus on understanding business idea generation, development, and evaluation. A key outcome of this module will be the plan for Phase two of the students Enterprise Project. Emphasis will be placed on developing one's own entrepreneurial orientation while practising effective teamwork.

[back to top](#)

6EL3*LEADING INNOVATION**

This course will explore leadership in an innovation context with the objective of providing a conceptual understanding of role model leadership, and an approach used to assist the development of personal leadership capacity. The student will develop an understanding of personal, interpersonal, and group skills. Personal leadership development, leadership in teams, and leadership from an organizational and societal perspective will be a focus. Leadership in driving innovation will be emphasized. [back to top](#)

6I03*SUSTAINABLE MANUFACTURING PROCESSES**

(Cross-listed as Materials Science *6I03)

Sustainable development, materials cycles, methods for measuring environmental impact, life cycle analysis, waste treatment and recycling technologies. [back to top](#)

6PD3*POWER DISTRIBUTION II**

This course introduces the different types of operating constraints as encountered by power system operators and engineers during real time operation of interconnected power grids. For each type of operating constraint, the most common operating strategies and control measures will be discussed and analyzed. [back to top](#)

6PM3*THE MANAGEMENT OF TECHNICAL PROJECTS**

Introduction to best practice in the management of technical projects including the use of planning, software and the management of people. [back to top](#)

MANUFACT***6RM3****ROBOT MECHANICS AND MECHATRONICS**

Basic robot categories; robot components; mobility/constraint analysis; workspace analysis; manipulator kinematics and motion trajectories; non- redundant and redundant sensing/actuation of manipulators; manipulator statics; singularities; manipulator dynamics; practical approach to electronics instrumentation, measurement system and transducers; Design of signal conditioning and filtering systems; mathematical modeling of both mechanical and electrical systems. [back to top](#)

6TB3*BIOTECHNOLOGY III/ ADVANCED BIOTECHNOLOGY**

This advanced course examines select topics of interest that reflect current methods utilized to produce new products and processes in the field of biotechnology. The course invites subject experts from various sectors of the biotech industry as guest lecturers. [back to top](#)

6X03*THE REGENERATION IMPERATIVE: LIVEABLE CITIES REVITALIZATION OF BUILT AND NATURAL ASSETS**

This course explores urban renewal with respect to concepts of the natural and built environment. Students are expected to apply various tools and evaluate the methods that promote best practices, in the context of theory and case studies.

[back to top](#)

***701**

THEORY AND PRACTICE OF POLICY ANALYSIS: FRAMEWORKS AND MODELS

Government structure and mandates for municipal, provincial and federal levels; procedures for legislation and policy setting; process of understanding societal values and preferences; establishment of policy goals and objectives; models and frameworks for the evaluation and analysis of public policy; application of frameworks and models to engineering and public policy problems.

[back to top](#)

***702**

SYSTEMS ENGINEERING AND PUBLIC POLICY

Application of linear programming, integer programming and dynamic programming to public policy applications; application of simulation modeling to evaluate scenarios; application of decision analysis approaches and software for micro- and macro-policy analysis problems; coupling of GIS-based approaches with conventional systems engineering tools; project planning and project management; soft systems techniques.

[back to top](#)

***705**

GREEN ENGINEERING, SUSTAINABILITY AND PUBLIC POLICY

Green engineering theory and guiding principles; sustainability at the regional and international levels; transportation and land-use interactions; new urbanism design; transit-oriented development; bicycle-friendly planning and design; building design to minimize energy, water and material resources; green building; green manufacturing and product design; sustainability indicators.

[back to top](#)

***706**

ENERGY AND PUBLIC POLICY

Energy policy; energy planning and forecasting; energy conservation and demand side management; case studies in current topics: utility privatization, nuclear energy generation, air quality issues; renewable energy technologies.

[back to top](#)

***707**

COMMUNICATION TECHNOLOGY AND PUBLIC POLICY

International trade and regulation; social issues relating to communication policy; research policy and funding; industrial/economic policy; relevant legislation; innovations in communication technology.

[back to top](#)

***708**

SPECIAL TOPICS IN ENGINEERING AND PUBLIC POLICY

Studies selected from specialized areas of research or representing special areas of expertise in areas of sustainability with regard to resource management, transportation, energy, and related fields.

[back to top](#)

709*EMERGING ISSUES, TECHNOLOGY AND PUBLIC POLICY**

Environmental threats that emerge from engineering innovation will be examined from the perspective of public policy development. Institutional effectiveness and policy implications for new programs will address greater interoperability of the institutional framework in various geographic regions. The objective of this course is to engage students in seminars, discussion and debate on contemporary societal issues for which technology and policy can be integrated to generate sustainable solutions.

[back to top](#)***710****INTERNATIONAL GOVERNANCE AND ENVIRONMENTAL SUSTAINABILITY**

In a world undergoing rapid environmental changes due to global warming, achieving sustainability is ever more difficult. International governance mechanisms, including the United Nations, NGOs and international treaties, play an increasingly important role. This course examines how policymaking at the international level relates to achieving sustainability, including affordable and sustainable technology and science-based solutions. It will introduce the students to the current debates in the international environmental governance realm, as well as the methods and structures that guide policy formulation.

[back to top](#)***719****SPECIAL TOPICS IN ENGINEERING/TECHNOLOGY ENTREPRENEURSHIP AND INNOVATION**

Studies selected from specialized areas of research or representing special areas of expertise in areas of technology commercialization; entrepreneurship and innovation.

[back to top](#)***725****PRACTICAL PROJECT MANAGEMENT FOR TODAY'S BUSINESS ENVIRONMENT**

This course covers the basics of project management techniques and tools, as well as advanced, adaptive, and emerging approaches to improve project success. Students will learn how to apply effective project management to a variety of common business situations, including starting a company, bringing a product to market, doing primary research and development, constructing a physical facility, and developing a major piece of software, among others. Case studies, guest speakers, and hands-on exercises will be used to explore real-life examples of project management successes and failures.

[back to top](#)**#730****RELIABILITY AND RISK MANAGEMENT**

The course presents a broad treatment of the subject of engineering decision, risk, and reliability. Emphasis is on (1) the modeling of engineering problems and evaluation of systems performance under conditions of uncertainty; (2) risk-based approach to lifecycle management of engineering systems; (3) systematic development of design criteria, explicitly taking into account the significance of uncertainty; and (4) logical framework for risk assessment and risk/benefit tradeoffs in decision making. The necessary mathematical concepts are developed in the context of engineering problems.

[back to top](#)***732****SUSTAINABLE ENERGY – TECHNOLOGY AND OPTIONS SELECTION**

Assessment of potential current and future energy systems, covering resources, extraction, conversion, and end-use, with emphasis on meeting regional and global energy needs in the 21st century in a sustainable manner. Renewable and conventional energy technologies are presented (solar, wave and tidal, wind, hydropower, biomass, geothermal, nuclear, fossil) and their attributes described within a framework that aids in evaluation and analysis of energy technology systems in the context of political, social, economic, and environmental goals.

[back to top](#)

#733**PROJECT MANAGEMENT**

Project Management is a critical skill in today's business environment. This course covers the basics of project management techniques and tools to improve project success. Students will learn how to apply effective project management to a variety of common business situations, including starting a company, bringing a product to market, constructing a physical facility, and developing a major piece of software, among others. Case studies and guest speakers will be used to explore real-life examples of project management successes and failures.

[back to top](#)***746****DESIGN OF SUSTAINABLE COMMUNITY INFRASTRUCTURE**

This course will give the underlying theory and practical applications for understanding the design of the following elements of a sustainable community: local food production systems; urban forestry; stormwater management systems; pedestrian zone and bikeway infrastructure; by-product management systems for recycling and composting.

[back to top](#)***747****ENERGY EFFICIENT BUILDINGS**

The objective of the course is to provide students with a good understanding of (1) building energy sources, (2) energy efficient technologies for commercial and industrial-type buildings, and (3) energy efficient buildings. Topics covered: Building major energy sources and areas of end use including building envelope, HVAC, distribution system, lighting system, internal loads, etc.; building energy balance, energy audit of buildings, energy conservation measures, building simulation tools, design of integrated systems.

[back to top](#)***748****DEVELOPMENT OF SUSTAINABLE COMMUNITIES**

Local economy as a basis for sustainable communities. Deciding on the role of the community (thinkers, makers, traders) and development of economic competitive advantage and the associated business clusters. Community corporations. Pro-community local governance. Regeneration of livable cities. Case studies on Ontario regional economies.

[back to top](#)***750****MODEL PREDICTIVE CONTROL DESIGN AND IMPLEMENTATION**

Majority of advanced control designs employed in practice use the Internal Model Control (IMC) structure and Model Predictive Control (MPC) concepts. The course presents theory and best implementation practices for control model identification, controller design, testing, and implementation. Upon completion of this course, the engineer will be able to perform the following: identify linear models for control, design and implement MPC controllers for an integrated plant, and optimize the process using the MPC steadystate features.

751*PROCESS DESIGN AND CONTROL FOR OPERABILITY**

Process design involves tradeoffs to achieve performance over a range of operations due to uncertainty, variability of inputs, and a range of production goals. A flexible design functions acceptably over the range and well at the typical conditions. Processes safety (seven layers, HAZOP, LOPA, quantitative analysis), effect of structure on reliability and plant dynamics. Classical supervisory control methods and typical applications to major equipment and systems.

[back to top](#)

752*SYSTEMS MODELING AND OPTIMIZATION**

Architecture of simulation programs, solution algorithms, integration of simulation models from different simulators. Steady-state and dynamic simulation via sequential modular and equation-oriented algorithms. Optimization of steady-state and dynamic performance, sensitivity of the optimum, multi-objective optimization. Analysis of plant data, gross error detection, parameter estimation to match the plant performance. Online monitoring and optimization of process performance.

[back to top](#)***753****ENTERPRISE OPPORTUNITY DEVELOPMENT**

This course follows on the introductory course SEP 6E03 and teaches the students how to develop a customer-centric startup by learning and applying the tools of primary market research, developing a proof of concept, learning the basics of managerial accounting, corporate finance and investor term-sheet negotiations, and finally developing a detailed 5-year financial plan.

[back to top](#)***754****PROCESS DESIGN AND INTEGRATION FOR MINIMAL ENVIRONMENTAL IMPACT**

The course focuses on integration of process units and on the design of Energy Utility Systems, Heat Exchanger Networks (HEN) and Water Distribution Systems and presents methodologies that lead to energy efficient, water saving and economically attractive designs. Methods for heat integration (HEN, utility selection, heat engines, heat pumps, refrigeration cycles, and pinch analysis), cogeneration and integrations with industrial sites, water and cooling minimization and their applications.

[back to top](#)***755****BUSINESS LAUNCH AND DEVELOPMENT**

The course will address the skills and knowledge needed to launch and sustain new Businesses, Products, or Services. The module will first examine business model types, business strategies and business strategy selection in the context of the existing situation. Students will also gain an understanding of how to manage the new business opportunity for growth and sustainability; leveraging internal and external resources; the role of value-chain management and timing; and the critical factors that contribute to a business/product/service launch success.

[back to top](#)***756****INTERNATIONAL WATER POLICY**

Water has been touted as 'blue gold', the 'new oil' and a potential catalyst for war in the 21st century. This seminar on international water policy addresses water law and policy at multiple scales from the community level to global governance regimes. This course will engage theories of property rights, policy change, and multi-level governance to examine different water policies and evaluate their design and performance in relation to major themes and debates associated with the global water crisis. The course will equip students with an interdisciplinary understanding of contemporary water problems, policies, and institutions, drawing from multiple approaches to institutional and policy analysis.

[back to top](#)***760****DESIGN THINKING**

This course will explore the creative design process, tools and methods that will enable students to discover, identify, and analyze opportunities and develop those opportunities into innovative design solutions. Based on a series of self-contained exercises and small projects, students will work to research a well-conceived design concept by the end of term.

Prerequisite:

Instructor permission

[back to top](#)

761*HUMAN - CENTERED DESIGN**

This course will introduce the human-centered design in a way that is understandable to technically trained individual with applications in product design. The course will follow the IDEO model for human-centered design: hear, create, and deliver. Students will learn processes, tools, and methods for prototyping, analyzing, visualizing, and validating a design with the goal of delivering innovative design solutions. Students will work in small teams to develop a specification by the end of the term, supported by scheduled gate reviews, in-class presentations, and peer review. The outcome of the course will be a final presentation where students will demonstrate their prototype. The course is studio-based with a lecture component.

Prerequisite:*SEP *760*[back to top](#)***762****PROTOTYPING TOOLS AND METHODS**

This course will enhance the prototyping capabilities of students. Students will select one stream of prototyping. This will include hardware prototyping and software prototyping but will be expanded depending on the current slate of degree-required projects in the Master of Engineering Design program. Students will be expected to develop basic hands-on competency in their chosen stream of prototyping and demonstrate their ability and knowledge through a lab project that contributes to their degree-required project.

Prerequisite:*SEP *760*[back to top](#)***763****SPECIAL TOPICS IN ENGINEERING DESIGN**

Studies selected from specialized areas of research or representing special areas of expertise in areas of engineering design with regard to either process systems and operations, product design or sustainable infrastructure.

[back to top](#)***770****TOTAL SUSTAINABILITY MANAGEMENT**

This course introduces sustainability within a unified framework of Total Sustainability Management that will teach the student how to deeply embed sustainability into the enterprise through the use of Design principles, Bill-of-rights of the Planet and through public policy. This approach will apply to not only company products but also to its business strategy and business model. Furthermore, the course will teach the student a problem-solving approach that combines innovation, design and policy to emphasize the synergetic interplay between them. The student will learn how to think of sustainability as a "Way of Thinking." The course will make liberal use of appropriate case studies, and call on several internal and external speakers who are recognized subject-matter experts.

[back to top](#)**771****W BOOTH SCHOOL OF ENGINEERING PRACTICE PRACTITIONERS FORUM**

This seminar series is intended to enhance the student's experiential learning by exposing the student body to innovative thinkers and practitioners in the areas of: Engineering Entrepreneurship and Innovation, Engineering Design, Engineering and Public Policy or Technology Entrepreneurship and Innovation. It should be considered a networking event to bring together our students, faculty and staff in a community atmosphere centered around learning initiative.

[back to top](#)

773**LEADERSHIP FOR INNOVATION**

This course will explore leadership in an innovation context with the objective of providing a conceptual understanding of role model leadership, and an approach used to assist the development of personal leadership capacity. The student will develop an understanding of personal, interpersonal, and group skills. Personal leadership development, leadership in teams, and leadership from an organizational and societal perspective will be a focus. Leadership in driving innovation will be emphasized and practiced by application during the School of Engineering Practice's Innovation Studio.

[back to top](#)***782****MODERN POWER DESIGN**

This course investigates how modern power systems are being designed and operated in different jurisdiction. The course will examine main attributes of a modern power system such as generation mix, demand side management, electricity market mechanisms, power system reliability, as well as the impacts of smart grids and microgrids on meeting future electricity demand.

[back to top](#)**772****INNOVATION STUDIO**

This is a studio-based course for all Engineering & Public Policy, Engineering Entrepreneurship & Innovation, Technology Entrepreneurship & Innovation, and Engineering Design students. Innovation Studio supports the students' degree-required project. Students participate in public events that engage the community. Students attend weekly working sessions to work on their projects.

[back to top](#)**773****LEADERSHIP FOR INNOVATION**

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