Mechanical & Industrial Engineering
UNIVERSITY OF TORONTO

COURSE AND OPTIONS SELECTION HANDBOOK

INDUSTRIAL ENGINEERING

3RD YEAR

WHAT IS COURSE & OPTIONS SELECTION ?

Each year the Office of the Registrar asks you to provide them with indicators as to which program option and technical elective courses you plan to take in the coming academic year. **The information that you provide to us through Course and Options Selection (COS) helps us identify the demand for program options and courses. This information is used for the course scheduling process and for uploading your course selections to ROSI.** You do not need to select your core courses in COS, these will be uploaded automatically to ROSI. When selecting your technical electives be sure that your selections meet the program requirements for your program of study.

Please be advised that students who do not participate in COS will not be guaranteed a space in technical elective courses, so it is in your interest to complete the survey. The enrollment caps on technical elective courses are set according to the demand indicated to us via the COS data.

Even though you have made your course selections through COS it is not possible to schedule every technical elective available to a program of study conflict free. The information collected from COS does however help the faculty minimize conflicts between technical electives that students have chosen.

We greatly appreciate your cooperation with this exercise, and we strongly suggest that you to take five minutes of your time to complete the survey. Even if you are returning from, or planning to go on PEY next year, we would still ask that you participate in completing the survey.

The COS website will be activated as of Tuesday, February 18, and will remain active until midnight, Tuesday, March 4.

COS Website Login
http://www.apsc.utoronto.ca/cos

CONTENTS

IMPORTANT DATES

DATE	
February 18 to March 4	**COURSE & OPTION SELECTION OPENS** **www.apsc.utoronto.ca/cos** Students may now login and make their curriculum selections for the upcoming academic year
Mid-July	**TIMETABLES BECOME AVAILABLE ON ROSI**
July 22	**COURSE SELECTION (ROUND 1) OPENS** **www.rosi.utoronto.ca** For electives offered by the Faculty of Engineering and Enhanced Enrollment Arts & Science electives. Students may now make changes to their timetable
August 6	**COURSE SELECTION (ROUND 2) OPENS** **www.rosi.utoronto.ca** For electives offered by the Faculty of Arts & Science
August 22	**LAST DAY TO PAY OR DEFER TUITION FEES**
September 4	**ENGINEERING FALL (F) LECTURES BEGIN** Last day to receive a 100% tuition refund if you are choosing to withdraw for the 2014-2015 academic year.
September 11	**ESIP & PEY REGISTRATION BEGINS** **www.engineeringcareers.utoronto.ca**
September 15	**DEADLINE TO SUBMIT COURSE REQUEST FORMS FOR FALL (F) & FULL-YEAR (Y) COURSES**

IMPORTANT DATES

DATE	
September 21	**FALL (F) & FULL-YEAR (Y) COURSE ADD DEADLINE** Last day to add or substitute Fall (F) or Full-Year (Y) Session courses Last day to receive a 100% tuition refund (with a minimum charge of $242) if you are choosing to withdraw for the 2014-2015 academic year.
November 3	**FALL (F) COURSE DROP DEADLINE** Last day to drop Fall (F) Session courses without academic penalty, withdraw from the Fall (F) session without academic penalty, or transfer to part-time studies for the Fall (F) session Last day to receive a 50% tuition refund if you are choosing to withdraw for the 2014-2015 academic year.
January 5	**ENGINEERING WINTER (S) LECTURES BEGIN**
January 12	**DEADLINE TO SUBMIT COURSE REQUEST FORMS FOR WINTER (S) COURSES**
January 18	**WINTER (S) COURSE ADD DEADLINE** Last day to add or substitute Winter (S) Session courses
March 8	**WINTER (S) & FULL YEAR (Y) COURSE DROP DEADLINE** Last day to drop Winter (S) Session and Full-Year (Y) courses without academic penalty, withdraw from the Winter (S) session without academic penalty, or transfer to part-time studies for the Winter (S) session.

CURRICULUM

FALL SESSION - YEAR 3		LEC/LAB/TUT/WGT.
CORE REQUIRED COURSES		
Industrial Ergonomics and the Workplace	MIE343H1	3/3/-/0.5
Design and Analysis of Information Systems	MIE350H1	3/1/1/0.5
Systems Modelling and Simulation	MIE360H1	3/2/1/0.5
NATURAL SCIENCE ELECTIVE (CHOOSE ONE):		
Engineering Biology	CHE353H1	3/-/1/0.5
Urban Engineering Ecology	CIV220H1	3/-/1/0.5
Terrestrial Energy Systems	CIV300H1	3/-/2/0.5
TECHNICAL ELECTIVE (CHOOSE ONE):		
Ergonomic Design of Information Systems	MIE344H1	3/3/-/0.5
Business Process Engineering	MIE354H1	3/2/-/0.5
Operations Research III: Advanced OR	MIE365H1	3/2/1/0.5
COMPLEMENTARY STUDIES ELECTIVE		
CS Elective	-	0.5

CAN I TAKE A NATURAL SCIENCE ELECTIVE OTHER THAN THOSE ON THIS LIST?
Yes. The extended list of approved natural science electives is available at **http://uoft.me/nse**. For many of the approved courses, the pre-requisites are waived for engineering students although you should check with the administering department (e.g. Department of Physics for PHY224H1) your eligibility. You should also consult the administering department whether or not you will be able to add the course yourself on ROSI's course selection days. **Please note that IndE students are NOT permitted to take PSY100H1 as their natural science elective.**

CAN I APPLY FOR A TECHNICAL ELECTIVE SUBSTITION?
No. You must choose a technical elective off the approved curriculum list. Only in fourth year are IndE students able to apply for a technical elective substition.

CURRICULUM

FALL SESSION - YEAR 3		LEC/LAB/TUT/WGT.
CORE REQUIRED COURSES		
Algorithms & Numerical Methods	MIE335H1	3/1/1/0.5
Resource and Production Modelling	MIE363H1	3/-/2/0.5
Quality Control and Improvement	MIE364H1	3/1/2/0.5
TECHNICAL ELECTIVE (CHOOSE ONE):		
Case Studies in Human Factors and Ergonomics	MIE345H1	3/-/2/0.5
Cases in Operations Research	MIE367H1	3/-/2/0.5
Facility Planning	MIE468H1	3/-/2/0.5
Reliability and Maintainability Engineering	MIE469H1	3/-/2/0.5
COMPLEMENTARY STUDIES ELECTIVE		
CS Elective	-	0.5

CAN I TAKE MY NATURAL SCIENCE ELECTIVE IN THE WINTER OR SUMMER TERM?

If the natural science elective you are interested in taking is only offered in the winter semester, you must first obtain formal approval from the MIE Undergraduate Office to overload. Many natural science electives on the extended list are also available in the summer. You will not need to apply to overload in this case.

WHAT'S THE DIFFERENCE BETWEEN AN AREA OF FOCUS AND A STREAM?

In the Mechanical Engineering program, students select streams. These streams require them to take a continued stream course in 4F from their stream selections in 3W. In the Industrial Engineering program, it is not mandatory to continue with courses in your particular area of focus. If you choose a Human Factors technical elective in third year, you can choose another Human Factors course in fourth year or choose a course in information engineering or operations reasearch.

HUMAN FACTORS

Industrial Engineers also improve productivity and efficiency by studying and improving the actual physical work environment. Human factors engineering is the study of people as workers and as managers, both from the physiological and psychological points of view. The study of human physiology, particularly the nervous system, leads to fascinating discoveries concerning reaction to stimuli, sensory perception, human performance at operator tasks, and people's ability to process information. These principles are applied to the design of human-machine systems, with particular attention to problems of information display, control layout, compensatory controls systems, and the design of work environments. People's behaviour in work organisations is examined from the point of view of individual and social psychology. These studies lead to important conclusions concerning managerial and leadership styles, organisational goals and incentives, employee relations, and the implementation of planned change.

For example, a mechanical engineer may design a new car, and a human factors engineer would be responsible for the design of the interior: control layout, seating, vision, reachability, usability in unusual circumstances, etc. A nuclear engineer will design a nuclear generator, and a human factors engineer will design the control system displays to minimise the probability of human error.

CORE COURSES

Evaluations & Textbook information accurate as of 2013/2014. Please note that this information is subject to change and should be used as a general guide ONLY

3F - MIE343H1F - INDUSTRIAL ERGONOMICS AND THE WORKPLACE

The Biology of Work: anatomical and physiological factors underlying the

design of equipment and work places. Biomechanical factors governing physical workload and motor performance. Circadian rhythms and shift work. Measurement and specification of heat, light, and sound with respect to design of the work environment.

TECHNICAL ELECTIVES (3RD YEAR)

3F – MIE344H1F – ERGONOMIC DESIGN OF INFORMATION SYSTEMS

The goal of this course is to provide an understanding of how humans and machines can be integrated with information systems. By the end of the course, students will be able to: Observe, and engage in dialogue with, users in ways that clarify users' views, needs, and capabilities; Develop all phases of the user interface design process in response to the needs of a user interface design project; Demonstrate initiative, personal responsibility and accountability in both personal and group contexts; Communicate information, analyses, and solutions accurately, reliably, orally, and in writing to a range of audiences (e.g., the professor, the TAs, classmates, users); Extend the insights they have gained from their experience through the course in their future interactions with users in the workplace; Use the completed project to promote their candidacy for employment opportunities.

TOPICS: Design of human-machine interfaces, Analysis of the impact of computers on people, Coverage of usability engineering and rapid prototyping design, Analysis of user mental models and their compatibility with design models, and Quantitative modelling of human-computer interaction.

EVALUATIONS: Design Project – 40%, Poster Session – 5%, Mid-Term Exam – 15%, Labs – 5%, Final Exam – 35%

TEXTBOOK: Interaction Design: Beyond Human-Computer Interaction – 3rd Edition, 2011, Wiley; Yvonne Rogers, Helen Sharp, and Jenny Preece; ISBN-13: 978-0470665763.

3W – MIE345H1S – CASE STUDIES IN HUMAN FACTORS AND ERGONOMICS

A detailed analysis will be made of several cases in which human factors methods have been applied to improve the efficiency with which human-machine systems operate. Examples will be chosen both from the area of basic ergonomics and from high technology. Emphasis will be placed on the practical use of material learned in earlier human factors courses.

HUMAN FACTORS

TOPICS: Understand and analyze human factors and ergonomics requirements outlined in a Request for Proposal (RFP); Respond to a RFP in a clear and concise manner to propose human factors and ergonomics analysis methods based on a problem description; Apply human factors and ergonomics methods to a set of circumstances under which humans are considered central to the proposed solution; Understand and mitigate obstacles associated with conducting human factors and ergonomics activities in different situations; Map human factors and ergonomics characteristics of different case studies to the Human-Tech ladder; Demonstrate initiative, personal responsibility, and accountability in both personal and group contexts; Use "real-world" knowledge acquired from this course to market candidacy for employment opportunities.

EVALUATIONS: Assignment #1 – 15%, Assignment #2 – 15%, Assignment #3 – 20%, Participation – 10%, Final exam – 40%

TEXTBOOK: N/A

TECHNICAL ELECTIVES (4TH YEAR ONLY)

4F – MIE448H1F – ENGINEERING PSYCHOLOGY AND HUMAN PERFORMANCE

The aim of the course is to study, and model, the relationship between human information processing and the design of human-machine systems, especially for complex workplaces.

TOPICS: Introduction to the concept of human information processing, Information theoretic models of human information processing, Theory of signal detection, Attention in Perception and Display Space, Spatial Cognition and Navigation, Memory, Human Decision Making, Attention Sharing / Multitasking, Mental Workload, Stress and Human Error, Automation and Human Performance

EVALUATIONS: Laboratory Projects – 30%, Mid-Term Exam – 25%, Final Examination – 45%

TEXTBOOK: C.D. Wickens, J.G. Hollands, S. Banbury & R. Parasuraman: Engineering Psychology andHuman Performance; (Fourth Edition) Pearson (2013)

HUMAN FACTORS

4W – MIE542H1S – HUMAN FACTORS INTEGRATION
The aim of this course is to develop an understanding of approaches to integrating human factors in systems design engineering, for complex, safety-critical environments; describe and apply methods and approaches for integrating Human Factors into design processes; understand systems design processes and cycle; develop an understanding of the roles and responsibilities of Human Factors practitioners within the design process and team; develop an understanding of how to communicate requirements arising from human factors integration analyses and methods; develop design concepts which meet the identified requirements; and to prepare for continuous learning through professional practice of HFI methods.

EVALUATIONS: Project Write-up – 5%, Case Study Analysis Write-up – 5%, HFI Analyses – 20%, Quizzes – 20%, Final Project (group) – 35%, Oral Presentation (individual) – 10%, Pop Quizzes – 5%

TEXTBOOK: N/A

FIELDS OF APPLICATION

Transportation, Communication, Healthcare, Military, Energy, Banking

COMPANIES

University Health Network, Candu Energy, AMEC-Nuclear Safety Solutions, SapientNitro, CIBC

LINKS

Human Factors and Ergonomics Society
www.hfes.org

OPERATIONS RESEARCH

Operations research and management science involve the mathematical modelling of real systems and processes with a view to being able to predict and optimally control their performance. For example, we can use statistics to determine how much inventory should be carried in a warehouse to minimise expected costs of carrying the stock and of shortages. We use queueing theory to analyse the waiting time of people or jobs waiting for service in banks, emergency rooms and production facilities. We use linear algebra (called linear programming) to determine the optimal product mix to maximise profit subject to capacity constraints on resources, or the optimal allocation of service facilities (like fire stations) to minimize the expected service time. Areas include scheduling, reliability, maintenance, forecasting, queueing, value analysis and decision making under uncertainty.

Operations Research came into its own during the Second World War, when it became apparent that many problems of scheduling and deployment of resources, which had previously been managed intuitively, could be quantitatively modelled and solved analytically. Since the war, operations research techniques and models have been applied in an ever-increasing variety of industries, from finance to healthcare to government. The modern manager can no longer rely on seat-of-the-pants judgement, but must take a scientific approach to decision making. Much of today's industrial engineering activity is the application of management science in support of decision making at all levels of any organisation.

CORE COURSES

Evaluations & Textbook information accurate as of 2013/2014. Please note that this information is subject to change and should be used as a general guide ONLY

OPERATIONS RESEARCH

3F – MIE360H1F – SYSTEMS MODELLING AND SIMULATION

Design, develop and use simulation models for improved decision making.

TOPICS: Mechanics of Simulation, Probability Review, Verification and Validation, Startup and Number of Replications, Comparing Alternative Systems, Queueing Theory and Forgetful Property, Exponential Distribution, Fitting Input Distribution, Goodness of Fit Tests, Input Processes, Experimental Design, Variance Reduction and Adv Topics

EVALUATIONS: Weekly labs – 5%, Lab Mid-Term – 20%, Class Mid-Term – 20%, SIMUL8 Project – 20%, Final Exam – 35%

TEXTBOOK: N/A

3W – MIE335H1S – ALGORITHMS & NUMERICAL METHODS

Algorithms (60%): Understand the importance of algorithm analysis, Learn to perform complexity analysis on algorithms, Learn how to balance accuracy and efficiency in algorithm selection, Apply algorithm understanding to encryption
Numerical methods (40%): Learn theoretical underpinnings behind matrix inversion and decomposition techniques, Learn how to select appropriate matrix inversion and decomposition methods, Gain experience programming in MATLAB

TOPICS: Course overview, Polynomial-time algorithms, Big O, Intro to encryption, mod and hash functions, Intro to RSA encryption, RSA computational issues, Decision algorithms: Greedy methods, Decision algorithms: NP-hard problems, Intro to numerical methods, Solving linear equations: Cholesky factorization, Solving linear equations: LU factorization, Revised simplex with LU, Solving nonlinear equations: Newton's method, Unconstrained nonlinear optimization

EVALUATIONS: Midterm – 35%, Final exam – 40%, Lab project – 20%, Lab homework – 5%

TEXTBOOK: Cormen, Leiserson, Rivest, Stein. Introduction to Algorithms, 3rd edition. The MIT Press 2009. ISBN 978-0-262-03384-8.

OPERATIONS RESEARCH

TECHNICAL ELECTIVES (3RD YEAR)

3F – MIE354H1F – BUSINESS PROCESS ENGINEERING

This course focuses on understanding multiple perspectives for grouping, assessing, designing and implementing appropriately integrated and distributed information systems to support enterprise objectives.
The emphasis is on understanding how Business Process Management techniques and tools can contribute to align an organization's business and information technology perspectives, as well as the characteristics of application and system types and the implications for their design, operation, and support of information needs. The course reviews platforms and technology infrastructure, including; legacy systems, client/server, the Internet, the World Wide Web, and the emergence of a web-service-based service oriented architecture

Students will work in the laboratory to develop business process that can be specified in BPMN and executed by information systems supporting BPEL, two industry standards for describing and implementing business process.

The course covers Information Systems concepts, tools and techniques, and it is addressed primarily to an audience of process/business analysts instead of targeting an audience of developers/programmers. After taking this course the students should have achieved the following objectives: Know the characteristics of business process management and workflow processes; Is able to make a process model based on an informal description, recognizing concepts such as case, task, work item, activity, role, organizational unit, resource, etc.; Can design and analyze a process (validation, verification, and performance analysis; Know the reference architecture of service-oriented business process management and workflow systems, and is aware of the basic functionality offered by contemporary systems, with an emphasis on web services and web-based information systems.

TOPICS: Introduction and Motivation to Business Processes Management, Petri Nets with applications to Workflow Modelling, Workflow and Groupware, Ad-hoc Processes, Social BP, Workflow Patterns, Event Diagrams, Process Orchestrations, Modelling Business Processes and Resource Management, Enterprise Architecture and BPMS, Service-Oriented Computing, Web-Services, and Composite Applications, Organization, Architecture and Standards Choreographies,

OPERATIONS RESEARCH

B2B Collaborations, Service Interaction Patterns, Business Process Modeling Notation, Process Choreographies and B2B Collaborations, Service Interaction Patterns, Choreography Consistency

EVALUATIONS: Final – 35%, Midterm – 25%, Assignments/Course Project – 40%

TEXTBOOK: "Business Process Management: Concepts, Languages, Architectures", Mathias Weske, 2nd Ed, ISBN 9783642286155, Springer-Verlag, 2012.

3F – MIE365H1F – OPERATIONS RESEARCH III: ADVANCED OR

Design of operations research models to solve a variety of open-ended problems. Linear programming extensions are presented: goal programming, column generation, Dantzig-Wolfe decomposition, and interior point solution methods. Non-linear programming solution methods are developed: optimality conditions, quadratic programming. Solutions to advances stochastic models: stochastic programming, Robust Optimization and Semi-Definite Programming.

EVALUATIONS: Homework – 15%, Midterm – 30%, Final Exam – 45%, Computational Project – 10%

TEXTBOOK: Introduction to Linear Optimization and Extensions with MATLAB by Roy H. Kwon, CRC Press 2013.

3W – MIE367H1S – CASES IN OPERATIONS RESEARCH

To provide students with the experience and confidence to apply Operational Research techniques to solve a variety of cases that industrial engineers may face in their professional life. The course will use one case per week which describes a real situation. Students will be required to analyze the case on their own, in a small group and with the class. Extensive preparation of each case prior to class participation is essential for the success of this course. After initial discussion, students will be required to fully solve the case, including a numerical solution. Timely individual analysis and solution of each case is critical to both class participation and development of the ability to analyze a case during the midterm and final exams.

EVALUATIONS: Weekly Cases – 40%, Participation – 10%, Midterm – 15%, Final exam – 35%

OPERATIONS RESEARCH

TEXTBOOK: N/A

4W – MIE468H1S – FACILITY PLANNING

Fundamentals of developing efficient layouts of production/ service systems and determining optimal locations of facilities in a network. Activity relationships, manufacturing flow patterns, layout procedure types (construction and improvement algorithms), manual and computerized layout techniques, single and multiple facility location, and supply chain (location) network-distribution design.

4W – MIE469H1S – RELIABILITY AND MAINTAINABILITY ENGINEERING

An introduction to the life-cycle costing concept for equipment acquisition, operation, and replacement decision-making. Designing for reliability and determination of optimal maintenance and replacement policies for both capital equipment and components. Topics include: identification of an item's failure distribution and reliability function, reliability of series, parallel, and redundant systems design configurations, time-to-repair and maintainability function, age and block replacement policies for components, the economic life for capital equipment, provisioning of spare parts.

TOPICS: Statistical Preliminaries, Basic Reliability Models, System Reliability, Replacement Decisions, Reliability Improvement through Inspection, Capital Equipment Replacement Decisions, Effective Use of Maintenance Resources, Data Collection and Reliability Testing, Analysis of Component Failure Data

EVALUATIONS: Quizzes – 10%, Midterm – 35%, Final Exam – 55%

TEXTBOOK: Maintenance, Replacement and Reliability Theory and Applications by Jardine, A.K.S and Tsang, A.H.C. Taylor & Francis, 2nd ed., 2012.

TECHNICAL ELECTIVES (4TH YEAR ONLY)

4W – MIE561H1S – HEALTHCARE SYSTEMS

The purpose of MIE 561 is to give students an opportunity to integrate the engineering tools learned in previous courses by applying them to real world problems. While the specific focus of the case studies used to

illustrate the application of engineering will be the Canadian health care system, the approach to problem solving adopted in this course will be applicable to any setting. This course will: Provide a framework for identifying and resolving problems in a complex, unstructured decision-making environment; Give students the opportunity to apply a problem identification framework through real world case studies; Provide insight into the appropriate uses (and abuses) of engineering techniques in a practical setting; Prepare students to become productive, practising engineers; Make students aware of the implications of context on the practice of engineering

EVALUATIONS: Group case study discussion – 10%, Case study reports – 40%, Midterm exam – 10%, Final exam – 40%

TEXTBOOK: "Public Health and Preventive Medicine in Canada" 5th edition by Chandrakant Shah

4F – MIE562H1F – SCHEDULING

This course takes a practical approach to scheduling problems and solution techniques, motivating the different mathematical definitions of scheduling with real world scheduling systems and problems. The linking theme for the course is the use of search (partition, relaxation, and inference) to solve hard combinatorial problems. A group project will require the implementation of two or more scheduling algorithms. Evaluation will be based on two terms tests, two assignments, the project, and the final exam. Students should have a basic knowledge of standard optimization techniques as taught in second and third year MIE courses.

TOPICS: Job shop scheduling, timetabling, project scheduling, and solution approaches including constraint programming, mixed-integer programming, local search, heuristics, and dispatch rules. Stochastic scheduling, complexity theory, recent research on decomposition techniques, and information engineering aspects of building scheduling systems for real world problems.

EVALUATIONS: Assignment #1 – 5%, Term Test #1 – 15%, Assignment #2 – 5%, Term Test #2 – 15%, Term Project – 15%, Final Exam – 45%

TEXTBOOK: Pinedo, M., Planning and Scheduling in Manufacturing and Services, Springer, 2nd edition, 2009

OPERATIONS RESEARCH

4F – MIE566HIF – DECISION ANALYSIS
Students taking this course will attain competence in formulating Bayesian decision analysis models, attain an understanding of methods for solving such models, and attain competence in using commercial software for solving such models

TOPICS: Intro, Decision Trees and Bayes Rule, Complex Decisions with Decision Trees, Bayesian Networks, Formulating Influence Diagrams, Solving Influence Diagrams, Attitude to Risk, Multi-Attribute Decisions, Continuous Uncertainty - Conjugate Distributions, Conjugate Distributions, Non-Conjugate Distribution, Multivariate Inference

EVALUATIONS: Project part 1 – 5%, Project part 2 – 5%, Lab Mid-Term – 40%, Project part 3 – 5%, Project part 4 – 5%, Lab Final Exam – 40%

TEXTBOOK: N/A

4F – APS502H1F – FINANCIAL ENGINEERING
This course will focus on capital budgeting, financial optimization, and project evaluation models and their solution techniques. In particular, linear, non-linear, and integer programming models and their solution techniques will be studied. The course will give engineering students a background in modern capital budgeting and financial techniques that are relevant in practical engineering and commercial settings.

FIELDS OF APPLICATION

Logistics, Supply Chain Management, Healthcare, Production System, Financial Engineering, Maintenance

COMPANIES

Canadian Tire, FedEx, Purolator, Wal-mart, Bombardier, Celestica, General Motors, Honda, Procter and Gamble, Ford Motor Company, St. Michael's Hospital, CIBC, Manulife Insurance, IBM, Oracle

LINKS

Canadian Operational Research Society
www.cors.ca

INFORMATION ENGINEERING

The Information Engineering specialization of the Industrial (Systems) Engineering program creates professionals that address the challenge of successfully applying information technology to help people and organizations innovate and become more efficient.

Our graduates have outstanding employment opportunities in numerous private and public organizations as well as in the global consulting firms that service them. There is current and future demand for professionals that combine expertise in process design and management, business analysis, project management, systems integration, and a fusion of industry knowledge and information technology skills.

Information engineering provides exciting and diverse career opportunities that encompass the development and evolution of information systems. Our graduates address the following challenging issues: how to provide doctors and nurses with timely access to electronic patient data wherever is needed, how to design information systems that run the business of online stores such as music download sites and bookstores, how to reduce large volumes of data into information that is useful to the decision-making processes of government officials, and how to take advantage of information technology to plan, coordinate and support disaster recovery and relief efforts

CORE COURSES

Evaluations & Textbook information accurate as of 2013/2014. Please note that this information is subject to change and should be used as a general guide ONLY

3F – MIE350H1F – DESIGN AND ANALYSIS OF INFORMATION SYSTEMS

MIE350 explores the software lifecycle, encompassing the planning, design, analysis, and implementation of software systems. Students learn

techniques and methodologies for requirements engineering, data flow diagrams, process modelling, and UML; these techniques are applied in a course project.

TOPICS: Software lifecycle, Structured software development, Agile software development, Computer-assisted software engineering tools, Organizational context, Project management, What are requirements?, Requirements gathering, Requirements analysis, Use Cases, Introduction to process modelling, Building data flow diagrams, Process modelling revisited, Use Case diagrams, Class diagrams, State diagrams, Activity diagrams, System design, Architecture design, Object Management Group, Coding vs Design, Change Management, Information System Development Challenges

EVALUATIONS: Term Project – 20%, Lab Quizzes – 15%, Midterm – 25%, Final Exam – 40%

TEXTBOOK: Systems Analysis & Design 5th Edition, Dennis, Wixom, and Roth. Wiley, 2012

3F – MIE360H1F – SYSTEMS MODELLING AND SIMULATION

See page 13.

3W – MIE335H1S – ALGORITHMS & NUMERICAL METHODS

See page 13.

4F – MIE463H1F – INTEGRATED SYSTEM DESIGN (FOURTH YEAR CORE)

Integrated System Design is a capstone course that integrates the various perspectives of an integrated system taught in third year, including: Optimization, Quality, Management, Information, and Economics. The course approaches systems design from a Business Process perspective. Beginning with the Business Processes, it explores the concept of Business Process Re-engineering. It extends the concept of business processes to incorporate perspectives such as cost, quality, time, behaviour, etc. The second part of the course focuses on business process design tools. Namely, software tools to both design, simulate and analyse business processes. The third part of the course explores the application of process design to various domains. Guest speakers are used to provide domain background.

4W – MIE459H1S – ORGANIZATIONAL DESIGN (FOURTH YEAR CORE)

This course examines how engineers as managers can create more

effective organizations. We focus on the following areas for improving organizational effectiveness: Conflict, power, and politics within an organization; Personal and professional networks within an organization; Alternative organizational structures, such as functional, divisional, geographic, matrix, and horizontal structures; Techniques for managing an organization's dependencies on its external (resource) environment; The role of innovation and organizational learning. Our perspective is based on past research and hands on practice in the management of organizations. The course will be linked to your team capstone project. The class will be divided into teams the first day and the teams will be formed around your capstone project team.

TOPICS: Introduction to Organizations and Organizational Theory, Strategy, Organizational Design and Effectiveness, Organizational Structure, External Environments, Inter-organizational Relationships, Designing Organization for International business, Manufacturing & Service Technologies, IT and E Business Information Technology Evolution, Org Size Lifecycle & Decline, Organizational Culture & Ethics, Innovation and Change Management, Decision Making Process, Conflict Power and Politics

EVALUATIONS: Team Presentations – 10%, Mid Term Exam – 30%, Final Team Report – 25%, Final Exam – 35%

TEXTBOOK: Richard Daft / Ann Armstrong. "Organizational Theory and Design – Canadian 2nd edition"

TECHNICAL ELECTIVES (3RD YEAR)

3F – MIE344H1F – ERGONOMIC DESIGN OF INFORMATION SYSTEMS

See page 9.

3F – MIE354H1F – BUSINESS PROCESS ENGINEERING

See page 14.

TECHNICAL ELECTIVES (4TH YEAR ONLY)

4F – MIE451H1F – DECISION SUPPORT SYSTEMS

This course provides students with an understanding of the role of a decision support system in an organization, its components, and the theories and techniques used to construct them. The course will cover basic technologies for information analysis, knowledge-based problem

INFORMATION ENGINEERING

solving methods such as heuristic search, automated deduction, constraint satisfaction, and knowledge representation.

4F – MIE562H1F – SCHEDULING
See page 17.

4F – MIE566H1F – DECISIONAL ANALYSIS
See page 18.

4W – MIE457H1S – KNOWLEDGE MODELING AND MANAGEMENT
MIE457 explores both the modelling of knowledge and its management within and among organizations. Knowledge modelling will focus on knowledge types and their semantic representation. It will review emerging representations for knowledge on the World Wide Web (e.g. RDF and ontologies) . Emerging knowledge modelling and automated reasoning software will be used in the laboratory.

TOPICS: IIntroduction to Ontologies, First-Order Logic, Methodologies, Common Logic, RDF (Resource Description Framework), OWL (Web Ontology Language), Rule Languages, Ontology-Based Search, Ontologies for Bioinformatics

EVALUATIONS: Ontology Design Project – 20%, Midterm – 30%, Final Exam – 50%

TEXTBOOK: N/A

4W – MIE561H1S – HEALTHCARE SYSTEMS
See page 16.

FIELDS OF APPLICATION

Data Analysis, Database Design, Business Process Modelling, Information Systems, Ontologies

COMPANIES

IBM, Microsoft, Ericsson, Walmart, Loblaw, Toronto Hydro, Environment Canada

DEGREE REQUIRMENTS

DEGREE EXPLORER

degreeexplorer.utoronto.ca

Degree Explorer is a tool designed to help students and advisors evaluate academic progress towards completion of requirements for graduation. Your assessment will be considered official only if confirmed by your department/division.

There is a planner tool that allows you to map out your degree and can help you determine if you are on track. Just because you are eble to enrol in a course on ROSI does not mean it will fullfill your degree requirements. To make sure the electives you plan to chose fullfill your degree requirements, consider using the "Planner" tool within degree explorer.

SUMMARY OF DEGREE REQUIREMENTS - AEMECBASC

CORE COURSES

Students must complete all core courses.

FIRST YEAR: APS111H1F, CIV100H1F, MAT186H1F, MAT188H1F, MSE101H1F, APS106H1S, APS112H1S, ECE110H1S, MAT187H1S, MIE100H1S

SECOND YEAR: MIE236H1F, MIE242H1F, MIE250H1F, MIE258H1F, MIE262H1F, MAT234H1S, MIE237H1S, MIE240H1S, MIE253H1S, MIE263H1S

THIRD YEAR: MIE343H1F, MIE350H1F, MIE360H1F, MIE335H1S, MIE363H1S, MIE364H1S

FOURTH YEAR: MIE490Y1Y, MIE463H1F, MIE459H1S

SEMINAR COURSES

Students must complete APS150H1F and MIE191H1S in order to graduate.

NATURAL SCIENCE (NS)

To graduate, you must take a 0.5 credit natural science course. 0.5 credits = 1 half-year course. This is typically taken in 3F.

DEGREE REQUIRMENTS

COMPLEMENTARY STUDIES (CS) AND HUMANITIES & SOCIAL STUDIES (HSS)

To graduate, you must take 2.0 credits in complementary studies, of which at least 1.0 credits are HSS courses. 1.0 credits = 1 full year course or 2 half-year courses. These are typically taken in second and fourth year.

TECHNICAL ELECTIVES

Students must take one of MIE345, MIE354, or MIE365 in 3F. Students must take one of MIE344, MIE367, MIE468, or MIE469 in 4W. Students take two technical electives in 4F, and two technical electives in 4W from the approved curriculum lists. Students are permitted to take at most two technical elective substitutes in their fourth-year (one in each semester), but are required to obtain formal Departmental approval from the Undergraduate Office.

PRACTICAL EXPERIENCE REQUIREMENT (PER)

Every student must complete a minimum of 600 hours of practical work before graduation. The nature of the work should form an integral part of a student's education and career development. It therefore must contain a good measure of responsibility (e.g., management of programs, systems, equipment, personnel, or finances), sound judgment and effective communication, and be supportive of the professional career of the student after graduation. Work in many facets of industry, government or public service would be acceptable for this requirement. This PER requirement can be obtained through summer internships. To add PER hours, please complete the **Practical Experience Form** (www.mie.utoronto.ca/undergrad/forms) and submit it to the MIE Undergraduate Office. If you have completed PEY (12-16 month internship), you have fullfilled the PER requirement and do not need to submit a PER form to the MIE Undergraduate Office.

ENGINEERING MINORS & CERTIFICATES

ENGINEERING MINORS & CERTIFICATES

In addition to academic programs in Core 8 subjects/TrackOne and Engineering Science, undergraduate Engineering students may pursue a number of minors and certificates that add breadth and depth to their academic careers.

To obtain a minor, students must take six (6) courses in a particular field. Currently, the faculty offers minors in the following: Bioengineering, Environmental Engineering, Sustainable Energy, Robotics and Mechatronics, Engineering Business. To obtain a certificate, students must take three (3) courses in particular field. Currently, the faculty offers certificates in the following: Engineering Business, Global Engineering, Entrepreneurship, Preventative Engineering and Social Development, Mineral Resources, Nuclear Engineering. Students complete their minor using their electives in Second, Third and Fourth Year and therefore should consider these minors while selecting their courses

HOW DO I ENROL IN A MINOR?

Each minor has a specific enrolment form for you to complete and submit to the Cross-Disciplinary Programs Office. Please visit **uoft.me/engminors Please note that enrolling in a minor does not guarantee you a spot in any of the engineering minor electives (for example, JRE300), as they are open to everyone.** To avoid dissappointment, plan ahead and select courses early (6 AM) on course selection days. You are responsible for making sure you fullfill your degree and minor requirements.

WHEN CAN I ENROL IN A MINOR?

Students can enrol in an Engineering Minor at any time in their program.

WHAT'S THE DIFFERENCE BETWEEN A MINOR AND A STREAM?

A minor appears on your Bachelor of Applied Science (BASc) degree upon graduation, unlike your stream choices which do not.

I DIDN'T GET INTO THE COURSES I WANTED TO, AND I'M WORRIED I WONT FINISH MY MINOR BEFORE GRADUATION. WHAT DO I DO?

Due to popularity, many engineering minor courses are offered in the summer. You are also welcome to complete those courses following graduation, it just may not appear on your degree until later. You can also visit the Cross-Displinary Programs Office to de-enrol you in a minor.

ENROLLMENT AND REGISTRATION

HSS/CS ELECTIVES

Complementary Studies (CS) can be broadly defined as studies in humanities, social sciences, arts, management, engineering economics and communication that complements technical curriculum. **Engineering, math or science courses—including astronomy and psychology—may not be used to fulfill your CS elective requirements.** Humanities & Social Studies (HSS) courses are a subset of CS courses, so you may take HSS-designated courses to fulfill your CS elective requirements. In general, MechE students take their HSS/CS electives in 2nd and 4th year.

To graduate, you must take 2.0 credits in complementary studies, of which at least 1.0 credits are HSS courses. 1.0 credits = 1 full year course or 2 half-year courses.

The University of Toronto's Faculty of Arts & Science teaches a large number of courses that cover topics in complementary studies, though not all are suitable to fulfill your CS/HSS elective requirements. For a list of faculty approved elective lists, please consult the following links:

HSS Courses http://uoft.me/hss
CS Courses http://uoft.me/cselectives

If an elective you are interested in taking is not on those lists and you feel it meets the criteria described above, you may submit a proposal to the faculty to approve an HSS/CS course **http://uoft.me/proposecs**

I'M NOT SURE IF THE COURSES I'D LIKE TO TAKE ARE APPROVED HSS OR CS COURSES. WHERE CAN I CHECK?

You can enter them into the Degree Explorer Planner (degreeexplorer.utoronto.ca) to see if they work to fullfil your HSS/CS requirements. You may also check if the course code appears on either of these lists: **http://uoft.me/hss** or **http://uoft.me/cselectives.**

CAN I TAKE EXTRA ENGINEERING COURSES TO FULLFILL MY HSS/CS REQUIREMENTS?

No. Engineering, math or science courses—including astronomy and psychology—may not be used to fulfill your CS elective requirements.

ENROLLMENT AND REGISTRATION

WILL MY HSS/CS ELECTIVES BE ADDED TO MY TIMETABLE AUTOMATICALLY? WHAT IF I AM ENROLLED IN A MINOR THAT REQUIRES THAT COURSE?
No, you must add them yourself on course selection days. Enrolling in a minor does not guarantee you a spot in the required courses for your minor, as they are open to everyone on course selection day. Plan ahead and act early (6 AM) to avoid dissappointment.

WHAT ARE ENHANCED ENROLMENT ARTS & SCIENCE ELECTIVES?
Based on student feedback indicating that it can be difficult to enrol in desired elective courses due to the priority given to Arts & Science students, the Engineering Registrar's Office has worked with the Faculty of Arts & Science to allow Engineering students to have early access and reserved spaces in some popular CS/HSS elective courses. As a result, Engineering students will be able to add select Arts & Science course sections starting on July 22 at 6 AM. For a list of these courses, consult the Enrolment and Registration Guide available on the faculty website.

I'M NOT SURE WHICH ELECTIVES TO TAKE.
The Arts & Science Student's Union puts together a publication called the Anti-Calender, which provides honest student feedback about many arts & science elective courses offered. **http://assu.ca/anti-calendar** You may also wish to consult upper-year students in regards to your elective choices.

NATURAL SCIENCE ELECTIVES

Natural Sciences (NS) are defined by the Canadian Engineering Accreditation Board as a component of the curriculum that includes elements of physics, chemistry, life sciences, or earth sciences. In general, MechE students take their Natural Science elective in 3rd year.

To graduate, you must take a 0.5 credit natural science course. 0.5 credits = 1 half-year course.

MIE offers CHE353, CIV220, and CIV300 as natural science electives. The faculty has since extended the list of approved natural science electives. Consult this link **http://uoft.me/nse** for the extended list. You do not need formal MIE approval to take courses from this list. If the course has prerequisites you have not taken, please meet with the specific department offering the course to discuss your eligibility. **Please note that IndE students are NOT permitted to take PSY100H1 as their natural science elective.**

ENROLLMENT AND REGISTRATION

OVERLOADS

Students that wish to take extra courses in addition to a full course load (to fullfil a minor for example), must obtain formal approval from the Undergraduate Office. **In general, a student wishing to overload must have obtained an overall 75% average or above in the previous academic semester.** If you have failed a course and must overload in order to graduate on time, this requirement may be waived. If you do not obtain formal approval to overload during the year, please consider that many engineering minor courses are also offered in the summer. To apply to overload, submit an **Overload Request Form** (www.mie.utoronto.ca/undergrad/forms) to the Undergraduate Office by the course add deadline. If you are unsure, add the courses on the course selection dates to secure a spot in the event your overload request is approved.

"EXT" OR EXTRA COURSES

Students who are overloading with an extra course that is beyond their degree requirements, may wish to make this course "EXT". EXT-designated courses do not get factored into GPA. To qualify for the Dean's List and many academic scholarships, GPA minimum requirements are calculated based on a full course load. If you feel that this extra course mark may bring down your average, it may be advantageous to make this course EXT. The deadline to make a course EXT is the same as the drop course deadline in each semester. Once your final grades are To make a course EXT, submit an **EXT Request Form** (www.mie.utoronto.ca/undergrad/forms) to the Undergraduate Office by the course drop deadline.

FAILED COURSES

If you have failed a core curriculum course, you can re-take it any time before graduation. Many first year engineering courses are offered during the summer, and we strongly advise you to take it during this time and not as an overloaded course during the year. If you were unsuccessful in a second or third year course that is a prequisite for an upper level course, you must retake the prequisite course first. To add a core curriculum course, submit the **Course Request Form** (www.mie.utoronto.ca/undergrad/forms) to the Undergraduate Office by one week before the add course deadline. To add a failed stream course, HSS/CS elective, or natural science elective, you may do so yourself on the course selection dates.

ENROLLMENT AND REGISTRATION

TECHNICAL ELECTIVE SUBSTITUTIONS (FOURTH YEAR ONLY)

If you are interested in taking a course that does not appear on the approved technical elective curriculum list as part of your degree requirments, you may apply for a technical elective substitution. **Students are permitted to take at most two technical elective substitutes in their fourth-year (one per semester), but are required to obtain formal Departmental approval from the Undergraduate Office**. If you believe taking this course is critical to your success, we strongly suggest you submit a technical elective substitution form early to avoid dissappointment in the case it is not approved. If your course is not approved as a technical elective substitute, you may consider taking is as an extra or overload course. To apply for a technical elective subsition, submit the **Techical Elective Substition Form** (www.mie.utoronto.ca/undergrad/forms) to the Undergraduate Office by one week before the add course deadline.

INDUSTRIAL
ENGINEERING
3RD YEAR

ENROLLMENT & REGISTRATION CHECKLIST

FEBRUARY - MARCH

COURSE & OPTIONS SELECTION
February 18 to March 4

- ☐ Read through this handbook
- ☐ Attend curriculum talks of interest, research, and consult upper year students to help inform your third year course selections
- ☐ Use **degreeexplorer.utoronto.ca** to map out your course selections and determine if you are on track to graduate
- ☐ **Make your technical elective and natural science elective selections through the COS portal (www.apsc.utoronto.ca/cos) by March 4.**

JULY - AUGUST

REVIEW YOUR TIMETABLE ON ROSI
Mid-July

- ☐ **Check that you have the correct registration status** (e.g. Part-time or Full-time) and that you are "INVIT" (Invited) for the fall session. If your registration status is incorrect, please contact the MIE Undergraduate Office at this time.
- ☐ **Review your timetamble to ensure you are enrolled in the correct core curriculum courses (Page 4).** If you are missing core curriculum courses, would like to make changes to your core course lecture/tutorial/practical sections, or need a failed core course added, you will not be able to do so yourself. Please complete a Course Request Form and submit it to the Undergraduate Office.
- ☐ **Review your timetable to view your technical elective and natural science selections.** If you participated in COS, your courses will appear at this time. If you did not participate in COS, your technical & natural science electives are missing, or you would like to make changes to the lecture/tutorial/practical sections of these courses, you will able to do so yourself on the course selection days.

INDUSTRIAL
ENGINEERING
3RD YEAR

ENROLLMENT & REGISTRATION CHECKLIST

- ☐ **If you have changed your mind about your stream or natural science selections, now is the time to plan.** Review page 32 for a list of resources that will help you determine which lecture/tutorial/practical sections fit your timetable so you are prepared for action on course selection day.
- ☐ **Make a plan as to which HSS/CS electives you would like to take in your fourth year.** Record the lecture/prac/tutorial sections so that you are ready to act quickly on course selection day. Please visit page 26 and page 34 for additional resources on selecting HSS/CS electives.

COURSE SELECTION (ROUND 1) OPENS 6 AM
July 22

- ☐ **You may now make changes to your timetable in terms of technical elective & natural science elective selections (provided there is space).** Log in early to avoid dissappointment. If you submited a Course Request Form, changes may begin to appear at this time.
- ☐ **You may now select HSS/CS electives offered by the Faculty of Engineering.**

COURSE SELECTION (ROUND 2) OPENS 6 AM
August 6

- ☐ **If applicable, you may now select or make changes to natural science electives offered by the Faculty of Arts & Science at this time.** Log in early to avoid dissappointment.

PAY OR DEFER TUITION FEES
August 22

- ☐ The deadline to pay or defer the minimum tuition payment to register occurs late-August. Visit www.fees.utoronto.ca for a detailed schedule. Once you pay or defer your tuition, your status will update from “INVIT” to “REG”.

INDUSTRIAL
ENGINEERING
3RD YEAR

ENROLLMENT & REGISTRATION CHECKLIST

FALL 2014

ENGINEERING FALL (F) SESSION LECTURES BEGIN
September 4

- ☐ First day of Third Year IndE!
- ☐ This is also the last day to receive a 100% tuition refund if you are choosing to withdraw for the 2014-2015 academic year.

COURSES REMOVED FOR NON-REGISTERED STUDENTS
September 8

- ☐ If you have not paid/deferred your minimum tuition payment, you will be removed from your courses as this time.

COURSE REQUESTS FORMS FOR FALL (F) & FULL-YEAR (Y) COURSES DUE
September 15

COURSE ADD DEADLINE FOR FALL (F) & FULL-YEAR (Y) COURSES
September 21

- ☐ Once classes begin, if you still want to make changes to any fall (F) session courses you can do so up until this date.
- ☐ This is the last day to receive a 100% tuition refund (with a minimum charge of $242) if you are choosing to withdraw for the 2014-2015 academic year.

COURSE DROP DEADLINE FOR FALL (F) COURSES
November 3

- ☐ This date is the deadline drop courses, switch to part-time studies, or withdraw from this session without academic penalty.
- ☐ This is the last day to receive a 50% tuition refund if you are choosing to withdraw for the 2014-2015 academic year.

INDUSTRIAL
ENGINEERING
3RD YEAR

ENROLLMENT & REGISTRATION CHECKLIST

WINTER 2015

ENGINEERING WINTER (S) SESSION LECTURES BEGIN
January 5

- ☐ You're halfway there!

COURSE REQUESTS FORMS FOR WINTER (S) COURSES DUE
January 12

COURSE ADD DEADLINE FOR WINTER (S) COURSES
January 18

- ☐ Once classes begin, if you still want to make changes to any winter (S) session courses you can do so up until this date.

COURSE DROP DEADLINE FOR WINTER (S) COURSES
March 8

- ☐ This date is the deadline drop courses, switch to part-time studies, or withdraw from this session without academic penalty.

ENROLLMENT & REGISTRATION QUICKLINKS

COURSE FINDER
coursefinder.utoronto.ca

- » Allows you to sort courses by times they are available (e.g. Thursdays at 12pm)
- » Allows you to sort courses by faculty and by requirements (e.g. Faculty of Engineering, Engineering HSS/CS Requirement)
- » Contains timetable information, the current enrollment, and wait-list information

DEGREE EXPLORER
degreeexplorer.utoronto.ca

- » Allows you to determine whether you are on track for graduation
- » Highlights which graduation requirements you are missing
- » Allows you to create and save course selection plans and determines whether your plan will fullfill graduation requirements

ENGSOC TIMETABLE BUILDER
schedule.skule.ca

- » A more visual timetable builder
- » Allows you to exercise different lec/pra/tut section options for your electives to determine which will work best for your schedule

ARTS & SCIENCE ANTI-CALENDAR
assu.ca/anti-calendar

- » A collection of student evaluations of over 1700 courses and instructors in the Faculty of Arts & Science
- » Can help guide your Arts & Science elective selections

ENROLLMENT & REGISTRATION QUICKLINKS

MIE UNDERGRADUATE FORMS

www.mie.utoronto.ca/undergrad/forms

» **Course Request Form:** For adding/removing CORE curriculum courses

All technical electives, HSS/CS electives, natural science electives, and stream courses you will be able to manage yourself on ROSI.

» **Overload Request Form:** For requesting permission to overload

» **EXT Request Form:** For indicating a course as EXT

» **Technical Elective Substitution Form:** For requesting a course to be counted as a technical elective substitution in fourth year

» **Practical Experience Form:** For adding any hours obtained for the Practical Experience Requirement (PEY students excepted)

» **Thesis Enrollment Form:** Form required for enrolling in a MIE undergraduate half-year or full-year thesis

WHAT FORM DO I USE IF I WANT A COURSE TO BE CONSIDERED FOR AN HSS/CS ELECTIVE THAT'S NOT ON THE APPROVED LISTS?

If an elective you are interested in taking is not on those lists and you feel it meets the criteria described on page 26, you may submit a proposal to the faculty to approve an HSS/CS course **http://uoft.me/proposecs**
It is good practice to select an approved HSS/CS elective as back-up, in the event your proposed course is not approved.

I'M PLANNING TO OVERLOAD BUT I CAN'T ADD THE COURSE ON ROSI, WHAT DO I DO?

Complete an Overload Request Form and submit it to the MIE Undergraduate Office. If it's an MIE course, we can manually add you to the course provided that there is space after course selection dates. If it's not an MIE course (JRE300 for example) please contact the administering department of that course for help adding it to your timetable.

MIE UNDERGRADUATE OFFICE

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PHONE (416) 978 6420

FAX (416) 978 7753

HOURS Monday - Friday, 10 AM to 4 PM

WWW.MIE.UTORONTO.CA/UNDERGRAD