Mechanical & Industrial Engineering
UNIVERSITY OF TORONTO

COURSE AND OPTIONS SELECTION HANDBOOK

MECHANICAL ENGINEERING

3RD YEAR

CONTENTS

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.** 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 submit your selections.

We greatly appreciate your cooperation with this exercise. It can be completed on Degree Explorer at the link: degreeexplorer.utoronto.ca

INFORMATION IN THIS HANDBOOK WAS UPDATED IN JANUARY 2021. COURSES, DEGREE REQUIREMENTS, AND DATES MAY CHANGE FROM YEAR TO YEAR, SO BE SURE TO CHECK THE CURRENT YEAR'S ACADEMIC CALENDAR

IMPORTANT DATES

DATE	
Early February	**CURRICULUM TALK: 3RD YEAR MECH CURRICULUM**
Mid February to Early March	**COURSE & OPTION SELECTION OPENS** **degreeexplorer.utoronto.ca** Students may now login and make their curriculum selections for the upcoming academic year
Early March	**LAST DAY FOR STUDENTS TO APPLY TO RE-ENROL OR SWITCH TO FULL-TIME FOR FALL SESSION***
Late July	**COURSE SELECTION (ROUND 1) OPENS *ACORN*** Students may now make changes to their timetable. Electives offered by the Faculty of Engineering and Enhanced Enrolment Arts & Science electives are now open for enrolment
Mid August	**COURSE SELECTION (ROUND 2) OPENS *ACORN*** For electives offered by the Faculty of Arts & Science
Late August	**LAST DAY TO PAY OR DEFER TUITION FEES**
Early September	**ENGINEERING FALL (F) LECTURES BEGIN**
Late September	**FALL (F) & FULL-YEAR (Y) COURSE ADD DEADLINE** Last day to add or substitute Fall (F) or Full-Year (Y) Session
Early November	**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
Early January	**ENGINEERING WINTER (S) LECTURES BEGIN**
Mid January	**WINTER (S) COURSE ADD DEADLINE** Last day to add or substitute Winter (S) Session courses
Early March	**WINTER (S) & FULL YEAR (Y) COURSE DROP DEADLINE** Last day to drop Winter (S) Session and Full-Year (Y) courses without academic penalty

*For fee and refund schedule information, follow the link below:

http://www.fees.utoronto.ca/sessions.htm

CURRICULUM

FALL SESSION - YEAR 3

CORE REQUIRED COURSES

COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Kinematics and Dynamics of Machines	MIE301H1	3 / 3 / 2 / 0.5
Fluid Mechanics	MIE312H1	3 / 1 / 1 / 0.5
Circuits with Applications to Mechanical Systems	MIE342H1	3 / 1.5 / 1 / 0.5
Engineering Economics and Accounting	MIE258H1	3 / - / 2 / 0.5
NATURAL SCIENCE ELECTIVE (CHOOSE ONE):		
Engineering Biology	CHE353H1	3 / - / 2 / 0.5
Urban Engineering Ecology	CIV220H1	3 / - / 1 / 0.5
Terrestrial Energy Systems	CIV300H1	3 / - / 2 / 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 **https://undergrad.engineering.utoronto.ca/wp-content/uploads/2019/07/2019-NS-Website-List-as-of-072419.pdf**

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.

CAN I CHANGE MY STREAMS IN FOURTH YEAR?

No. In order to graduate, you must take a course following each of your stream selections in 3W. If you find another 4F stream course interesting, you may take it in place of a technical elective in addition to your two continued stream courses.

CURRICULUM

WINTER SESSION - YEAR 3

Core Required Courses

COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Design for the Environment	MIE315H1	3 / - / 1 / 0.5
Heat and Mass Transfer	MIE313H1	3 / 1.5 / 2 / 0.5
Numerical Methods I	MIE334H1	3 / - / 1.5 / 0.5
Stream Options (Choose Two):		
MANUFACTURING		
Introduction to Quality Control	MIE304H1	3 / 1 / 2 / 0.5
MECHATRONICS		
Analog and Digital Electronics for Mechatronics	MIE346H1	3 / 1.5 / 1 / 0.5
SOLID MECHANICS & DESIGN		
Mechanics of Solids II	MIE320H1	3 / 1.5 / 1 / 0.5
ENERGY & ENVIRONMENT		
Thermal Energy Conversion	MIE311H1	3 / 3 / - / 0.5
BIOENGINEERING (CHOOSE ONE):		
Cellular and Molecular Biology	CHE354H1	3 / 1 / 2 / 0.5
Physiological Control Systems	MIE331H1	3 / 1 / 1 / 0.5

CAN I TAKE THREE STREAMS?

It is strongly advised that mechanical engineering students do not overload in third year. Only under exceptional circumstances are overloads granted in third year. If you are interested in taking three streams, you must first obtain formal approval from the MIE Undergraduate Office to overload.

WHAT IF I WANT TO CHANGE MY STREAM CHOICES FROM WHAT I SELECTED ON COS?

Please see the Important Dates for more details on opportunities to change your stream selections. Please try to make an informed decision for your COS selections to ensure you have a spot.

MANUFACTURING

Manufacturing, the transformation of materials and information (technology) into useful products for human beings, is the cornerstone to many economic activities. It is a versatile skill, with employment opportunities existing over a wide range of Canadian industry, including automotive, microelectronics, aeronautics, pharmaceutical, etc.

It is an exciting, creative field, where engineers get to design from cradle-to-grave. You must understand how an idea can be produced, and at what cost. This design may also include the manner the product should be disposed of or recycled. It is a truly international field, with demand around the world. Within Canada , average earnings of all employees in manufacturing are 22% higher than average earnings across all economic occupations in Canada.

STREAM COURSES

3W - MIE304H1S - INTRODUCTION TO QUALITY CONTROL

In manufacturing and service industries alike, quality is viewed as an important strategic tool for increasing competitiveness. Continuous quality improvement is a key factor leading to a company's success. With more emphasis on quality, the cost and the product cycle time are reduced and the communication between producer and customer is improved.

TOPICS: Introduction to quality engineering. Quality standards and certification. TQM. Modeling processes with simulation. Making inferences about product quality from real or simulation output data. Introduction to statistical process control. Control charts for variables and attributes. Process capability analysis. Lot Acceptance Sampling.

MANUFACTURING

4F - MIE422H1S - AUTOMATED MANUFACTURING
Introduction to Computer Integrated Manufactuing. Definitions, terminology. Organization of manufacturing systems. Introduction to NC machines. Introduction to robotics. Types of robot motion. Robot kinematics. Jacobians, singularities. Robot motion trajectories. Interpolation, spline fits. Robot joint control. Flexible manufacturing systems, justification. Robot cell design. Group technology. Design of group technology cell. Programmable logic controllers.

TOPICS: Introduction to Computer Integrated Manufacturing, Introduction to robotics and kinematics, CNC Basics, CNC Programming, Programmable Logic Controllers (PLCs) FMS, Table-top manufacturing, Group technology

SUGGESTED TECHNICAL ELECTIVES (4TH YEAR)

MIE440H1 - Design of Innovative Products
MSE401H1 - Materials Selection in Design II
FOR424H1 - Innovation and Manufacturing of Sustainable materials
MIE469H1 - Reliability and Maintainability Engineering
MIE506H1 - MEMS Design and Microfabrication
MIE519H1 - Advanced Manufacturing Technologies
MSE443H1 - Polymers and Composite Engineering

FIELDS OF APPLICATION

Automation, Manufacturing Management, Funamental Technology, Process Design, Machine Programming

LINKS

Canadian Society of Manufacturing Engineers
www.sme.org/smecanada

MANUFACTURING MINOR

SAMPLE COURSE SELECTION FOR MINOR (3RD YEAR)

FALL SESSION

CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Kinematics and Dynamics of Machines	MIE301H1	3 / 3 / 2 / 0.5
Fluid Mechanics	MIE312H1	3 / 1 / 1 / 0.5
Circuits with Applications to Mechanical Systems	MIE342H1	3 / 1.5 / 1 / 0.5
Engineering Economics and Accounting	MIE258H1	3 / - / 2 / 0.5
Natural Science Elective (Choose One):		
Engineering Biology	CHE353H1	3 / - / 2 / 0.5
Urban Engineering Ecology	CIV220H1	3 / - / 1 / 0.5
Terrestrial Energy Systems	CIV300H1	3 / - / 2 / 0.5

WINTER SESSION

CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Design for the Environment	MIE315H1	3 / - / 1 / 0.5
Heat and Mass Transfer	MIE313H1	3 / 1.5 / 2 / 0.5
Numerical Methods I	MIE334H1	3 / - / 1.5 / 0.5
Stream Options (Choose Two):		
MANUFACTURING		
Introduction to Quality Control	MIE304H1	3 / 1 / 2 / 0.5
MECHATRONICS		
Mechanics of Solids II	MIE320H1	3 / 1.5 / 1 / 0.5

***Note: If you are pursuring any minor please refer to the Academic Calender for more information on taking the required courses to acheive that minor. This may require overloading. Taking a stream does not mean you will get a minor in that area.**

MANUFACTURING MINOR

SAMPLE COURSE SELECTION FOR MINOR (4TH YEAR)

FALL SESSION

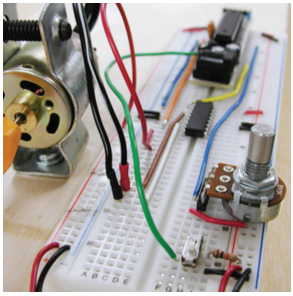
CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Capstone Design	MIE490Y1	- / - / 4 / 1.0
STREAM COURSES (TWO OF):		
MANUFACTURING		
Automated Manufacturing	MIE422H1	2 / 3 / - / 0.5
SOLID MECHANICS & DESIGN		
Machine Design	MIE442H1	3 / 1.5 / 3 / 0.5
TECHNICAL ELECTIVES (ONE OF):		
Materials Selection in Design	MSE401H1	2 / 2 / 1 / 0.5
COMPLEMENTARY STUDIES ELECTIVE		
CS Elective	-	- / - / - / 0.5

WINTER SESSION

CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Capstone Design	MIE491Y1	- / - / 4 / 1.0
TECHNICAL ELECTIVES (THREE OF):		
* Advanced Manufacturing Technologies	MIE519H1	3 / - / - / 0.5
Human Factors Integration	MIE542H1	3 / - / 2 / 0.5
Innovation and Manufacturing of Sustainable Materials	FOR424H1	2 / - / 1 / 0.5
COMPLEMENTARY STUDIES ELECTIVE		
CS Elective	-	- / - / - / 0.5

HIGHLIGHTED COURSES WILL COUNT TOWARDS YOUR MINOR
This is assuming you allocate the second year Manufacturing (MIE221) course to the minor.

MECHATRONICS



Ten years ago it was comparably easy to explain the functions of a camera to a young engineer, even though the mechanisms were complex. Today, it is nearly impossible since the design of a camera not only involves mechanics and optics, but also electronics and software. The design of such products and processes requires a synergetic combination of mechanical and electrical engineering and computer science.

As with our mechanical engineering program, mechatronics at U of T emphasizes design. You will learn the skills needed to design and build mechatronic systems and that includes mechanical design (mechanical, hydraulic, pneumatic, thermal), electronic design, programming skills and their integration into functional systems.

As Canada's largest and oldest mechatronics program, you will have access to well-established labs where you put theory into action as well as cutting edge technology provided by our outstanding professors, support engineers and graduate students. Remember, U of T is Canada's best research university! You benefit from our established mechatronics graduate studies. As part of the 4th year Mechatronics Principles course (MIE 444F), students are divided into small groups and asked to develop an autonomous vehicle that will navigate through a maze. The class is concluded with a competition.

STREAM COURSES

3W - MIE346H1S - ANALOG AND DIGITAL ELECTRONICS FOR MECHATRONICS
A study of the fundamental behaviour of the major semiconductor devices (diodes, bipolar junction transistors and field effect transistors). Development of analysis and design methods for basic analog and digital electronic circuits and devices using analytical, computer and laboratory tools.

TOPICS: Laplace Transform for Circuit Analysis, Operational Amplifiers, Filters and Tuned Amplifiers, Diodes, Signal Generators and Waveform-Shaping Circuits, MOSFETs, BJTs, OpAmps and Data Converters, Digital Logic Circuits. Lab topics include Voltage Controlled Oscillator, Diode Circuits, Transistors and Relays, Analog Pulse

MECHATRONICS

Width Modulations Motor Driver, Digital Logic and Stepper Motor Driver.

4F - MIE404H1F - CONTROL SYSTEMS I
Analysis of stability, transient and steady state characteristics of dynamic systems. Characteristics of linear feedback systems. Design of control laws using the root locus method, frequency response methods and state space methods. Digital control systems. Application examples.

TOPICS: MATLAB & Simulink, Feedback control and PID, Root Locus Design, Frequency Response Analysis, Magnetic Levitation

SUGGESTED TECHNICAL ELECTIVES (4TH YEAR)

AER307H1 - Aerodynamics
AER525H1 - Robotics
MIE444H1 - Mechatronics Principles
MIE438H1 - Microprocessors and Embedded Microcontrollers
MIE443H1 - Mechatronics Systems: Design and Integration
MIE505H1 - Micro/Nano Robotics

FIELDS OF APPLICATION

Robotics, Sensing and Control Systems, Medical imaging, Computer aided and integrated manufacturing systems, Microcontrollers/PLCs, Mobile Apps

LINKS

Institute for Robotics and Mechatronics
irm.utoronto.ca

ROBOTICS AND MECHATRONICS MINOR

SAMPLE COURSE SELECTION FOR MINOR (3RD YEAR)

FALL SESSION

CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Kinematics and Dynamics of Machines	MIE301H1	3 / 3 / 2 / 0.5
Fluid Mechanics	MIE312H1	3 / 1 / 1 / 0.5
Circuits with Applications to Mechanical Systems	MIE342H1	3 / 1.5 / 1 / 0.5
Engineering Economics and Accounting	MIE258H1	3 / - / 2 / 0.5
Natural Science Elective (Choose One):		
Engineering Biology	CHE353H1	3 / - / 2 / 0.5
Urban Engineering Ecology	CIV220H1	3 / - / 1 / 0.5
Terrestrial Energy Systems	CIV300H1	3 / - / 2 / 0.5

WINTER SESSION

CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Design for the Environment	MIE315H1	3 / - / 1 / 0.5
Heat and Mass Transfer	MIE313H1	3 / 1.5 / 2 / 0.5
Numerical Methods I	MIE334H1	3 / - / 1.5 / 0.5
Stream Options (Choose Two):		
MANUFACTURING		
Introduction to Quality Control	MIE304H1	3 / 1 / 2 / 0.5
MECHATRONICS		
Analog and Digital Electronics for Mechatronics	MIE346H1	3 / 1.5 / 1 / 0.5

***Note: If you are pursuring any minor please refer to the Academic Calender for more information on taking the required courses to acheive that minor. This may require overloading.**

Taking a stream does not mean you will get a minor in that area.

ROBOTICS AND MECHATRONICS MINOR

SAMPLE COURSE SELECTION FOR MINOR (4TH YEAR)

FALL SESSION

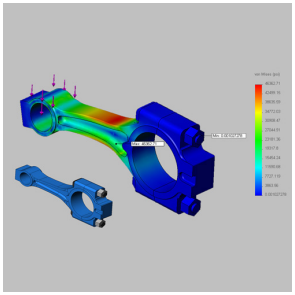
CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Capstone Design	MIE490Y1	- / - / 4 / 1.0
STREAM COURSES (TWO OF):		
MANUFACTURING		
Automated Manufacturing	MIE422H1	2 / 3 / - / 0.5
MECHATRONICS		
Control Systems I	MIE404H1	3 / 3 / 2 / 0.5
TECHNICAL ELECTIVES (ONE OF):		
Mechatronics Principles	MSE401H1	2 / 2 / 1 / 0.5
COMPLEMENTARY STUDIES ELECTIVE		
CS Elective	-	- / - / - / 0.5

WINTER SESSION

CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Capstone Design	MIE491Y1	- / - / 4 / 1.0
TECHNICAL ELECTIVES (THREE OF):		
Mechatronics Systems: Design and Integration	MIE443H1	2 / 5 / - / 0.5
Microprocessors and Embedded Microcontrollers	MIE438H1	2 / 3 / - / 0.5
COMPLEMENTARY STUDIES ELECTIVE		
CS Elective	-	- / - / - / 0.5

HIGHLIGHTED COURSES WILL COUNT TOWARDS YOUR MINOR
This is assuming you allocate the second year Mechanical Engineering Design (MIE243) course to the minor.

SOLID MECHANICS & DESIGN



Solid mechanics is the analysis of stress, strain and deflection. It is one of the core technical areas of mechanical engineering. Applications of solid mechanics are common in: the design of virtually every product; creating manufacturing processes and equipment; biomechanics as related to medicine and dentistry; many fields of graduate research.

STREAM COURSES

Evaluations & Textbook information accurate as of 2017/2018. Please note that this information is subject to change and should be used as a general guide ONLY

3W - MIE320H1S - MECHANICS OF SOLIDS II

Three-dimensional stress transformation, strain energy, energy methods, finite element method, asymmetric and curved beams, superposition of beam solutions, beams on elastic foundations, buckling, fracture mechanics, yield criteria, stress concentration, plane stress and strain. Finite Element Method.

4F - MIE442H1F - MACHINE DESIGN

Introduction to the fundamental elements of mechanical design including the selection of engineering materials, load determination and failure analysis under static, impact, vibration and cyclic loads. Surface failure and fatigue under contact loads, lubrication and wear. Consideration is given to the characteristics and selection of machine elements such as bearings, shafts, power screws and couplings. In place of your project, you may choose to take two machine shop courses at George Brown College. The courses are Basic Machine Operation plus one of the two advanced courses: Advanced Machining or Basic Welding Operations.

SOLID MECHANICS & DESIGN

SUGGESTED TECHNICAL ELECTIVES (4TH YEAR)

MIE440H1 - Design of Innovative Products
MSE401H1 - Materials Selection in Design II
MIE402H1 - Vibrations
MIE408H1 - Thermal and Machine Design of Nuclear Power Reactors
MIE550H1 - Advanced Momentum, Heat and Mass Transfer
CHE475H1 - Biocomposites: Mechanics and Bioinspiration
MIE439H1 - Biomechanics I
MIE441H1 - Design Optimization
MIE469H1 - Reliability and Maintainability Engineering
MIE506H1 - MEMS Design and Microfabrication
MIE540H1 - Product Design
MSE442H1 - Surgical and Dental Implant Design

FIELDS OF APPLICATION

Geomechanics (Modeling the shape of planets, tectonics, and earthquake prediction), Infrastruction (Designing foundations or structures), Mechanical Design (Desiging load bearing components for vehicles, powertrain design), Manufacturing (Metal and polymer forming processes, machining), Biomedical (Implant design, bone mechanics, modeling stress phenomena controlling cellular and molecular processes), Materials Science (Composite design, allow microstructions, material processing design), Microelectronics (Failure resistant packaging)

LINKS

The Canadian Society for Mechanical Engineering
www.csme-scgm.ca

The Society of Automotive Engineers
www.sae.org

ENERGY & ENVIRONMENT

The energy industry is one of the biggest in Canada, dominated by oil and gas, nuclear power and electricity. Environmental engineers play a pivotal role in improving polluted environments, designing facilities that directly affect our modern economy, public health and safety, and designing environmentally-responsible products and processes. Their knowledge of physics, chemistry, and biological processes allows them to address problems such as protecting air, water and land quality; providing safe drinking water; treating and disposing of industrial wastes; preventing environmental problems by designing "cleaner" manufacturing processes; and developing alternative energy sources. Mechanical engineers in this field have a strong foundation in thermal dynamics and fluid mechanics. Engineers with a firm knowledge of environmental processes and solutions are widely sought after by employers in both industry and government.

STREAM COURSES

3W - MIE411H1F - THERMAL ENERGY CONVERSION

Engineering applications of thermodynamics in the analysis and design of heat engines and other thermal energy conversion processes within an environmental framework. Steam power plants, gas cycles in internal combustion engines, gas turbines and jet engines. Refrigeration, psychrometry and air conditioning. Fossil fuel combustion and advanced systems includes fuel cells.

TOPICS: Vapor Power Cycles, Gas Power Cycles, Refrigeration and Heat pumps, Psychrometry and ideal Gas Mixture, Efficient Energy Utilization

4F - MIE515 - ALTERNATIVE ENERGY SYSTEMS

This course covers the basic principles, current technologies and applications of selected alternative energy systems. Specific topics include solar thermal systems, solar photovoltaic systems, wind, wave, and tidal energy, energy storage, and grid connections issues.

ENERGY & ENVIRONMENT

SUGGESTED TECHNICAL ELECTIVES (FOURTH YEAR)

MIE407H1 - Nuclear Reactor Theory and Design
MIE516H1 - Combustion and Fuels
CIV440H1 - Environmental Impact and Risk Assessment
FOR424H1 - Innovation and Manufacturing of Sustainable Materials
MIE408H1 - Thermal and Machine Design of Nuclear Power Reactors
MIE507H1 - Heating, Ventilating, Air Conditioning (HVAC) Fundamentals
MIE517H1 - Fuel Cell Systems

FIELDS OF APPLICATION

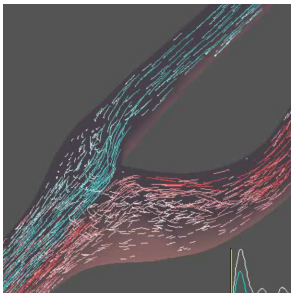
Power generation, Automotive (engine design, intake, exhaust, and cooling system design), Aerodynamics (Wind power systems, car body design), Fluid pumping systems (Oil and gas pipelines), Manufacturing (Die-casting, metal processing), Electronics (electronics cooling, ink-jet printing), MEMS systems (microfluidics), Environmental assessment (pollution control).

LINKS

Association of Energy Engineers
www.aeecenter.org

Institute for Sustainable Energy
energy.utoronto.ca

BIOENGINEERING



Biomedical engineers design and develop products for the most complex system on earth – the human body. Artificial organs, medical imaging devices, drug delivery systems are innovative and lifesaving solutions that arise from applying engineering principles to medical problems. Biomedical engineering jobs are expected to increase by 31.4% over the next seven years, more than double the average predicted rate in other fields.

STREAM COURSES

Students may choose to take either BME331 **OR** CHE354 for their 3W stream Course.

3W - MIE331H1S - PHYSIOLOGICAL CONTROL SYSTEMS

Prerequisite: CHE353H1F

The purpose of this course is to provide undergraduate engineering students with an introduction to physiological concepts and selected physiological control systems present in the human body. Due to the scope and complexity of this field, this course will not cover all physiological control systems but rather a selected few. This course will combine linear control theory, physiology, and neuroscience with the objective of explaining how these complex systems operate in a healthy human body.

TOPICS: Homeostasis, modeling physical systems (Laplace transform), transfer functions & block diagrams, endocrine system, cardiovascular system, system response in time and frequency domains, stability analysis, nervous system, design of PID controllers, controllability and observability, system identification

3W - CHE354H1S- CELL & MOLECULAR BIOLOGY

Prerequisite: CHE353H1F

To introduce students to concepts and techniques relevant to bioengineering research, including cell cultivation, molecular biology, protein biochemistry, and genetic engineering. In addition to opportunities for hands-on learning and application of bioengineering techniques and

BIOENGINEERING

instrumentation, this course will explain fundamental aspects of biomolecular chemistry that govern bioengineering practice.

4F - MIE520H1F - BIOTRANSPORT PHENOMENA
Application of conservation relations and momentum balances, dimensional analysis and scaling, mass transfer, heat transfer, and fluid flow to biological systems, including: transport in the circulation, transport in porous media and tissues, transvascular transport, transport of gases between blood and tissues, and transport in organs and organisms.

TOPICS: Control Volume Approach (Reynold's Transport Theorem - mass and momentum), Differential Approach (Fluid Statics, Rheology, Navier-Stokes, Euler, Bernoulli), Dimenional Analusis, Real Flows, Mass Transfer, Heat Transfer

SUGGESTED TECHNICAL ELECTIVES (FOURTH YEAR)

MIE414H1 - Applied Fluid Mechanics
MIE508H1 - Fluids of Biological Systems
BME520H1 - Imaging Case Studies in Clinical Engineering
BME595H1 - Medical Imaging
CHE475H1 - Biocomposites: Mechanics and Bioinspiration
MIE533H1 - Non-destructive Evaluation
MIE439H1 - Biomechanics I
MIE504H1 - Applied Computational Fluid Dynamics
MSE440H1 - Biomaterials Processing and Properties
MIE448H1 - Engineering Psychology and Human Performance

FIELDS OF APPLICATION

Bioinformatics (software for bio modelling), Biotechnology (products related to agriculture & environment), Instrumentation and Diagnostics (tools for research, hospital diagnostic equipment), Medical Devices (prosthetics, pace makers), Therapeutics (Pharmaceuticals), Biomedical Suppliers (development of lab and medical equipment)

LINKS

Institute of Biomaterials and Biomedical Engineering (IBBME)
ibbme.utoronto.ca

Club for Undergraduate Biomedical Engineering (CUBE)
cube.skule.ca

BIOENGINEERING MINOR

SAMPLE COURSE SELECTION FOR MINOR (3RD YEAR)

FALL SESSION

CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Kinematics and Dynamics of Machines	MIE301H1	3 / 3 / 2 / 0.5
Fluid Mechanics	MIE312H1	3 / 1 / 1 / 0.5
Circuits with Applications to Mechanical Systems	MIE342H1	3 / 1.5 / 1 / 0.5
Engineering Economics and Accounting	MIE258H1	3 / - / 2 / 0.5
Natural Science Elective (Choose One):		
Engineering Biology	CHE353H1	3 / - / 2 / 0.5
Urban Engineering Ecology	CIV220H1	3 / - / 1 / 0.5
Terrestrial Energy Systems	CIV300H1	3 / - / 2 / 0.5

WINTER SESSION

CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Design for the Environment	MIE315H1	3 / - / 1 / 0.5
Heat and Mass Transfer	MIE313H1	3 / 1.5 / 2 / 0.5
Numerical Methods I	MIE334H1	3 / - / 1.5 / 0.5
Stream Options (Choose Two):		
BIOENGINEERING		
Cellular and Molecular Biology	CHE354H1	3 / 1 / 2 / 0.5
SOLID MECHANICS & DESIGN		
Mechanics of Solids II	MIE320H1	3 / 1.5 / 2 / 0.5

***Note: If you are pursuring any minor please refer to the Academic Calender for more information on taking the required courses to acheive that minor. This may require overloading.**

Taking a stream does not mean you will get a minor in that area.

BIOENGINEERING MINOR

SAMPLE COURSE SELECTION FOR MINOR (4TH YEAR)

FALL SESSION

CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Capstone Design	MIE490Y1	- / - / 4 / 1.0
STREAM COURSES (TWO OF):		
BIOENGINEERING		
Biotransport Phenomena	MIE520H1	3 / - / 1 / 0.5
SOLID MECHANICS & DESIGN		
Machine Design	MIE442H1	3 / 1.5 / 3 / 0.5
TECHNICAL ELECTIVES (ONE OF):		
Industrial Ergonomics and the Workplace	MIE343H1	3 / 3 / - / 0.5
COMPLEMENTARY STUDIES ELECTIVE		
CS Elective	-	- / - / - / 0.5

WINTER SESSION

CORE REQUIRED COURSES	COURSE CODE	LEC/LAB/TUT/WGT.
Capstone Design	MIE491Y1	- / - / 4 / 1.0
TECHNICAL ELECTIVES (THREE OF):		
Biomechanics I	MIE439H1	3 / 2 / - / 0.5
Innovation and Manufacturing of Sustainable Material	FOR424H1	2 / - / 1 / 0.5
Design Optimization	MIE441H1	3 / 2 / - / 0.5
COMPLEMENTARY STUDIES ELECTIVE		
CS Elective	-	- / - / - / 0.5

HIGHLIGHTED COURSES WILL COUNT TOWARDS YOUR MINOR

DEGREE REQUIRMENTS

DEGREE EXPLORER degreeexplorer.utoronto.ca

Degree Explorer is a planning tool designed to help students and advisors evaluate academic progress towards completion of requirements for graduation. It is not a transcript. It 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 ACORN does not mean it will fullfill your degree requirements.

TO GRADUATE, YOU NEED

- All Core and Stream Courses
- 2.0 CS Credits (1.0 or more must be HSS)
- 0.5 Natural Science Credits
- 2.0 Technical Elective Credits
- 600 hours of professional experience, or PEY credit
- At least one design course

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. 0.5 credits = 1 half year course. These are typically taken in second and fourth year, or in the summer (have to pay extra tuition). For a list of faculty approved elective lists, please consult the following links. You can also request other A&S courses to act as a substitute:

HSS Courses https://undergrad.engineering.utoronto.ca/academics-registration/electives/humanities-social-science-hss-electives/
CS Courses https://undergrad.engineering.utoronto.ca/academics-registration/electives/complementary-studies-cs-electives/

TECHNICAL ELECTIVES

- One in first semester in 4th year, three in second semester in 4th year
- Select from list of approved electives
- Can apply for another course to substitute for a Technical Elective
- Can substitute at most two technical electives

PRACTICAL EXPERIENCE REQUIREMENT (PER)

- Minimum of 600 hours to graduate
- Work should support professional career of student
- Form must be filled out and submitted to MIE Undergrad Office
- If you do PEY, you do not need to submit PER form

NATURAL SCIENCE ELECTIVES

The curriculum has 3 pre-approved Natural Science electives which are: CHE353, CIV220, and CIV300. There is also an extended the list of approved natural science electives. **https://undergrad.engineering.utoronto.ca/academics-registration/electives/natural-science-ns-electives/**

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. A certificate requires three (3) courses. There are many minors and certificates, which are listed and detailed at **undergrad.engineering.utoronto.ca** Enroling for a minor puts it on your Degree Explorer, which can help you plan. You can de-enrol at any point.

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 **undergrad.engineering.utoronto.ca Please note that enrolling in a minor does not guarantee you a spot in any of the engineering minor electives, as they are open to everyone.** To avoid disappointment, plan ahead and select courses at 6 AM on course selection days. You are responsible for making sure you fulfill the requirements.

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.

WILL MY HSS/CS ELECTIVES BE ADDED TO MY TIMETABLE AUTOMATICALLY? WHAT IF I AM ENROLED IN A MINOR THAT REQUIRES THAT COURSE?

No, you must add them yourself on course selection days. Enroling in a minor does not guarantee you a spot in its required courses.

I'M NOT SURE WHICH ELECTIVES TO TAKE.

The Arts & Science Student's Union puts together a publication called the Anti-Calendar, which provides honest student feedback about many arts & science elective courses offered. **http://assu.ca/anti-calendar**

ENROLMENT AND REGISTRATION

OVERLOADS

- To take more than 5 courses in a semester, must get approval from undergrad office
- Need to have 75%+ average in previous semester or extenuating circumstances

"EXT" OR EXTRA COURSES

- If taking a course not needed for your degree, you can apply to designate it as EXT
- Mark will not count towards your GPA, but till shows on transcript
- Credit can be used for minors/certificates
- Deadline to designate EXT is the same as drop deadline

FAILED COURSES

If you have failed a core curriculum course, you must re-take it at the next available opportunity. Many first year engineering courses are offered during the summer. 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 (**https://www.mie.utoronto.ca/programs/undergraduate/undergraduate-office/) 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.

ENROLMENT & REGISTRATION QUICKLINKS

COURSE FINDER — **coursefinder.utoronto.ca**
- Timetable, enrolment, waitlists

DEGREE EXPLORER — **degreeexplorer.utoronto.ca**
- Plan and check on track to graduate

ENGSOC TIMETABLE BUILDER — **schedule.skule.ca**
- Visual timetable builder

ARTS & SCIENCE ANTI-CALENDAR — **assu.ca/anti-calendar**
- Course descriptions and reviews

MIE UNDERGRADUATE FORMS — **https://www.mie.utoronto.ca/programs/undergraduate/forms-policies/**
- PER, Course request, TES, etc.

MIE UNDERGRADUATE OFFICE

Room 109, Mechanical Building, 5 King's College Rd.

EMAIL undergrad@mie.utoronto.ca

PHONE (416) 978 6420

HOURS Monday - Friday, 9 AM to 4 PM

WWW.MIE.UTORONTO.CA