Mechanical Engineering in Memorial University of Newfoundland

Mechanical and Mechatronics Engineering courses are identified by a four-digit numbering system, the first two digits signifying the following:

The first digit denotes the academic term during which the course is normally offered.

The second digit denotes the primary areas of study, namely:

| 1: Materials Science |
| --- |
| 2: Mechatronics |
| 3: Dynamics |
| 4: Thermal Science |
| 5: Fluid Mechanics |
| 6: Solid Mechanics |
| 7: Design/Project courses |
| 8: Other regular courses |
| 9: Special Topics |

Non-departmental Engineering courses are designated by ENGI.

Mechanical and Mechatronics Engineering courses are designated by ME.

\*\*Engineering One Term\*\* -

- Required Courses:

1. Chemistry 1050 or 1200

2. 3 credit hours in English at the 1000 level or any Critical Reading and Writing course

3. Mathematics 1000, 1001, 2050

4. Physics 1050, 1051

5. ENGI 1010, 1020, 1030, 1040

\*\*Fall - Academic Term 3\*\* -

- Required Courses:

1. ENGI 3101, 3424

2. ME 3101, 3102, 3301, 3401

\*\*Winter\*\* -

- Required Courses:

1. ENGI 001W or 002W

\*\*Spring - Academic Term 4\*\* -

- Required Courses:

1. ENGI 4430

2. ME 4302, 4402, 4501, 4601

\*\*Fall\*\* -

- Required Courses:

1. ENGI 001W or 002W or 003W

\*\*Winter - Academic Term 5\*\* -

- Required Courses:

1. ENGI 4421

2. ME 5103, 5201, 5502, 5602

\*\*Spring\*\* -

- Required Courses:

1. ENGI 002W or 003W or 004W

\*\*Fall - Academic Term 6\*\* -

- Required Courses:

1. ME 6202, 6303, 6403, 6701, 6702

- Elective Courses:

- Students in the Biomedical Technical Stream must also take Human Kinetics and Recreation 2311 in Academic Term 6.

- Students in the Petroleum Technical Stream must also take PROC 6202 in Academic Term 6.

\*\*Winter\*\* -

- Required Courses:

1. ENGI 003W or 004W or 005W (optional)

\*\*Spring - Academic Term 7\*\* -

- Required Courses:

1. ME 7203, 7704

- Elective Courses:

- 6 credit hours from Technical Stream Required Courses, Academic Term 7

- For students in the Biomedical Technical Stream, one Technical Stream Required Course is replaced by Human Kinetics and Recreation 2311, taken in Academic Term 6.

- For students in the Petroleum Technical Stream, one Technical Stream Required Course is replaced by PROC 6202, taken in Academic Term 6.

- 3 credit hours from Technical Stream Elective Courses.

- One free elective which must be a 2000-level or higher course from any academic unit. Selection of a course must be approved by the Head of the Department of Mechanical and Mechatronics Engineering and must be completed before Academic Term 8.

\*\*Fall\*\* -

- Required Courses:

1. ENGI 004W or 005W (optional) or 006W (optional)

\*\*Winter - Academic Term 8\*\* -

- Required Courses:

1. ENGI 8152

2. ME 8705

- Elective Courses:

- 3 credit hours from Technical Stream Required Courses, Academic Term 8

- 6 credit hours from Technical Stream Elective Courses

- A student must select one of the Technical Streams in the areas of Biomedical, Mechanics and Materials, Mechatronics, Petroleum, and Thermo-Fluids.

- Technical Stream required courses must be chosen according to the student's stream as outlined below in the [Technical Stream Required Courses Table](https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/6/4/#d.en.328544).

- Technical Stream elective courses must be chosen according to the student's stream as outlined below in the [Technical Stream Elective Courses Table](https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/6/4/#d.en.328545).

- A student must choose one course in Academic Term 7 and two courses in Academic Term 8 according to the student's stream from the [Technical Stream Elective Courses Table](https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/6/4/#d.en.328545) or other courses as approved by the Head of the Department of Mechanical and Mechatronics Engineering.

- The selection of a course as a technical stream course from outside these lists requires the approval of the Head of the Department of Mechanical and Mechatronics Engineering.

Technical Stream Required Courses Table:

\*\*Biomedical Stream:\*\*

- \*\*Academic Term 6:\*\*

- Human Kinetics and Recreation 2311

- \*\*Academic Term 7:\*\*

- Medicine 6250

- \*\*Academic Term 8:\*\*

- Human Kinetics and Recreation 4703

\*\*Mechatronics Stream:\*\*

- \*\*Academic Term 7:\*\*

- ME 7205

- ME 7703

- \*\*Academic Term 8:\*\*

- ME 8305

\*\*Petroleum Stream:\*\*

- \*\*Academic Term 6:\*\*

- PROC 6202

- \*\*Academic Term 7:\*\*

- PROC 7291

- \*\*Academic Term 8:\*\*

- PROC 8291

\*\*Thermo-Fluids Stream:\*\*

- \*\*Academic Term 7:\*\*

- ME 7405

- ME 7404

- \*\*Academic Term 8:\*\*

- ME 8406

Technical Stream Elective Courses Table:

\*\*Biomedical Stream:\*\*

- \*\*Elective Courses:\*\*

- ECE 7410

- ECE 8410

- ME 7204

- ME 7205

- ME 7603

- ME 8504

\*\*Mechanics and Materials Stream:\*\*

- \*\*Elective Courses:\*\*

- ME 7105

- ME 7603

- ME 8106

- ME 8304

- ME 8605

- ME 8606

\*\*Mechatronics Stream:\*\*

- \*\*Elective Courses:\*\*

- ECE 7200

- ECE 7410

- ECE 8410

- ECE 8610

- ME 7204

- ME 8304

\*\*Petroleum Stream:\*\*

- \*\*Elective Courses:\*\*

- CIV 8580

- ME 7405

- ME 7503

- ME 8106

- PROC 7171

- PROC 8292

- PROC 8276

\*\*Thermo-Fluids Stream:\*\*

- \*\*Elective Courses:\*\*

- ME 7503

- ME 7603

- ME 8407

- ME 8504

- ME 8505

- ME 8506

\*\*Course Title:\*\* ME 3101 Chemistry and Physics of Engineering Materials I

\*\*Course Information:\*\* ME 3101 is an introduction to the structure and properties of engineering materials, with a focus on materials such as semiconductors, ceramics, glasses, and polymers. Topics include a review of atomic bonding, discussion of basic crystalline and amorphous structures, point and line defects, and the role these structural features play in elastic and plastic deformations, yield, fracture, glass transition, thermal conductivity, thermal expansion, specific heat, and electrical conductivity.

\*\*CR:\*\* PROC 5092, the former ENGI 2205

\*\*EQ:\*\* The former ENGI 3911

\*\*LH:\*\* At least four 3-hour sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* Chemistry 1050 or Chemistry 1200

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303761>

\*\*Course Title:\*\* ME 3102 Production Technology

\*\*Course Information:\*\* ME 3102 provides an overview of production, including production strategies, dimensioning and tolerancing, basic material removal processes, forming and shaping processes, casting, molding, extrusion, and joining processes. The course also covers computer-aided machining, new technologies, and design for manufacture.

\*\*EQ:\*\* The former ENGI 3941

\*\*LH:\*\* At least eight 3-hour sessions per semester

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303770>

\*\*Course Title:\*\* ME 3301 Dynamics

\*\*Course Information:\*\* ME 3301 includes kinematics and kinetics of particles using rectangular, normal/tangential, and polar coordinates; relative motion using rotating axes; two-dimensional kinematics and kinetics of rigid bodies; force-acceleration, work-energy, and impulse-momentum methods.

\*\*CR:\*\* The former ENGI 2313

\*\*EQ:\*\* The former ENGI 3934

\*\*OR:\*\* Tutorial 1 hour per week

\*\*PR:\*\* ENGI 1010, Mathematics 1001

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303767>

\*\*Course Title:\*\* ME 3401 Thermodynamics I

\*\*Course Information:\*\* ME 3401 is a macroscopic approach to heat, work, and energy; properties of pure substances; conservation of mass and energy for open and closed systems; thermal efficiency and coefficient of performance; second law of thermodynamics; entropy; second law analysis of thermodynamic systems; second law efficiency, and an introduction to simple thermodynamic cycles.

\*\*EQ:\*\* The former ENGI 3901

\*\*OR:\*\* Tutorial 1 hour per week

\*\*PR:\*\* Mathematics 1001

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303773>

\*\*Course Title:\*\* ME 4302 Mechanisms and Machines

\*\*Course Information:\*\* ME 4302 includes an overview of mechanisms within machines; analytical and computer-aided methods for position, velocity, and acceleration analysis of moving mechanisms; power transmission; kinematics and kinetics of planar mechanisms; static and dynamic loads on mechanisms and an introduction to mechanism synthesis. Students will complete an analysis project.

\*\*CR:\*\* The former ENGI 3933

\*\*EQ:\*\* The former ENGI 4932

\*\*LH:\*\* Two or three 2-hour computer simulation laboratory sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* ME 3301 or the former ENGI 3934

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303762>

\*\*Course Title:\*\* ME 4402 Thermodynamics II

\*\*Course Information:\*\* ME 4402 examines thermodynamic cycles: power and refrigeration applications; human comfort and air conditioning: mixture of gases and vapours, humidity, psychrometrics; chemically reacting mixtures and combustion; exergy analysis.

\*\*EQ:\*\* The former ENGI 4901

\*\*LH:\*\* At least three 1.5-hour sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* ME 3401 or the former ENGI 3901

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303733>

\*\*Course Title:\*\* ME 4501 Fluid Mechanics I

\*\*Course Information:\*\* ME 4501 examines fluid statics; fluid flow phenomena; control volume analysis; conservation of mass, momentum, and energy; Bernoulli equation; head losses, applications of conservation laws: flow measurement devices; pipe networks; momentum devices, dimensional analysis, boundary layer phenomena, lift and drag.

\*\*CR:\*\* The former ENGI 4661, the former ENGI 4913

\*\*EQ:\*\* The former ENGI 4961, the former ENGI 5961

\*\*LH:\*\* Five 1-hour sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* ME 3301 or the former ENGI 3934, ME 3401 or the former ENGI 3901

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303747>

\*\*Course Title:\*\* ME 4601 Mechanics of Solids I

\*\*Course Information:\*\* ME 4601 examines stress and strain analysis applied to bars and beams in axial, torsion and bending; beam deflection, plane stress and strain, stress and strain transformations in two dimensions and Mohr’s circle.

\*\*CR:\*\* The former ENGI 4312

\*\*EQ:\*\* The former ENGI 4934

\*\*LH:\*\* At least four 1-hour sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* ENGI 1010

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303744>

\*\*Course Title:\*\* ME 5103 Chemistry and Physics of Engineering Materials II

\*\*Course Information:\*\* ME 5103 examines aspects of chemical and physical processes and microscopic structure relevant to the production and use of engineering materials, focusing on metals, alloys, silicates, Portland cement, plastics and adhesives, composites, and wood. Topics include solid-state solutions and compounds, alloy structures, phase diagrams, reaction rates, solid-state transformations, polymerization, oxidation and corrosion, hardness, creep, fatigue, fracture toughness and visco-elastic deformation.

\*\*CR:\*\* PROC 5092, the former ENGI 3205

\*\*EQ:\*\* The former ENGI 5911

\*\*LH:\*\* At least four 3-hour sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* ME 3101 or the former ENGI 3911

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303760>

\*\*Course Title:\*\* ME 5201 Mechatronics I

\*\*Course Information:\*\* ME 5201 involves the modeling of electro-mechanical systems and an introduction to basic analog and digital electronic devices. Topics covered include lumped-parameter modeling of electro-mechanical systems, basic electronic components and semiconductors, introduction to op amps, digital logic and number systems, microcontroller technology and interfacing (switches, LEDs, steppers, solenoids, A/D and D/A conversion).

\*\*CR:\*\* The former ENGI 4951

\*\*EQ:\*\* The former ENGI 5952

\*\*LH:\*\* Five 3-hour sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* ENGI 1040, ENGI 3424

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303755>

\*\*Course Title:\*\* ME 5502 Fluid Mechanics II

\*\*Course Information:\*\* ME 5502 examines differential analysis of fluid motion; conservation of mass: continuity equation; conservation of momentum: Navier-Stokes equations; conservation of energy; basic film lubrication theory, boundary layer flows; compressible flows.

\*\*CR:\*\* The former ENGI 5913, the former ENGI 6661, the former ENGI 6961

\*\*EQ:\*\* The former ENGI 5962

\*\*LH:\*\* At least three 1-hour sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* ME 4501 or the former ENGI 4961 or the former ENGI 5961

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303757>

\*\*Course Title:\*\* ME 5602 Mechanics of Solids II

\*\*Course Information:\*\* ME 5602 examines stresses due to combined loads, asymmetric bending, transformation of stresses and strains, principal stresses and strains (in two and three dimensions), static failure theories, stress concentration, energy methods, method of superposition, buckling of columns, thin- and thick-walled pressure vessels and contact stresses.

\*\*CR:\*\* The former ENGI 5312

\*\*EQ:\*\* The former ENGI 5931

\*\*LH:\*\* At least four 1-hour sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* ME 4601 or the former ENGI 4934

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303753>

\*\*Course Title:\*\* ME 6202 Control Systems I

\*\*Course Information:\*\* ME 6202 examines modeling, analysis and design of feedback control systems using classical controller design methods. Topics covered include linear system modeling using Laplace transforms, control system stability, time domain analysis - root locus design, frequency domain analysis - bode diagram and Nyquist design, PID Control.

\*\*CR:\*\* The former ENGI 6925

\*\*EQ:\*\* The former ENGI 6951

\*\*LH:\*\* At least three 1-hour sessions per semester OR 1-hour tutorial per week

\*\*PR:\*\* ME 5201 or ECE 5610 or the former ENGI 5951 or the former ENGI 5952

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303768>

\*\*Course Title:\*\* ME 6303 Mechanical Vibrations

\*\*Course Information:\*\* ME 6303 examines single degree of freedom systems: free vibration, energy methods, response to harmonic excitation, response to arbitrary inputs, rotating unbalance, vibration isolation; two degree of freedom systems: natural frequencies and mode shapes, vibration absorption.

\*\*CR:\*\* The former ENGI 5932

\*\*EQ:\*\* The former ENGI 6933

\*\*LH:\*\* At least four 2-hour sessions per semester

\*\*PR:\*\* ME 3301 or the former ENGI 3934

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303745>

\*\*Course Title:\*\* ME 6403 Heat Transfer I

\*\*Course Information:\*\* ME 6403 examines modes of heat transfer; conduction: steady 1-D conduction, thermal resistance, extended surfaces (fins), lumped capacitance analysis, 1-D transient conduction; convection: Newton’s law of cooling, convection heat transfer coefficient, external boundary layer flows, internal flows; radiation: principles, properties, exchange factors, black body radiation, and enclosures, radiation shields.

\*\*CR:\*\* The former ENGI 5602

\*\*EQ:\*\* The former ENGI 6901

\*\*LH:\*\* At least one 3-hour session per semester OR tutorial 1 hour per week

\*\*PR:\*\* ME 4402 or the former ENGI 4901, ME 5502 or the former ENGI 5962

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303750>

\*\*Course Title:\*\* ME 6701 Computer Aided Engineering Applications

\*\*Course Information:\*\* ME 6701 introduces a variety of Computer Aided Engineering (CAE) applications based on advanced 3D CAD modeling. The fundamentals of 3D modeling are covered. CAE includes assembly modeling, mechanism animation, and finite element analysis. Applications include Computer Aided Manufacturing (CAM); model-based inspection; reverse engineering; document/drawing production; data exchange; and data management. Lab exercises provide exposure to solid modeling and CAE applications using CAD/CAM/CAE tools.

\*\*CR:\*\* The former ENGI 7962

\*\*EQ:\*\* The former ENGI 6928, the former ENGI 7928

\*\*LH:\*\* At least ten 2-hour computer laboratory sessions per semester

\*\*PR:\*\* ENGI 1030, ME 3102 or the former ENGI 3941

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303730>

\*\*Course Title:\*\* ME 6702 Mechanical Component Design I

\*\*Course Information:\*\* ME 6702 examines adequacy assessment and synthesis of machine elements with a focus on failure prevention, safety factors, and strength; static failure and fatigue analysis of components. Topics include the design of power screws, bolted connections, welds, and shafts.

\*\*CR:\*\* The former ENGI 5926

\*\*EQ:\*\* The former ENGI 5927, the former ENGI 6929

\*\*LH:\*\* At least four 3-hour computer laboratory sessions per semester

\*\*PR:\*\* ME 5602 or the former ENGI 5931

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303764>

\*\*Course Title:\*\* ME 7104 Industrial Materials

\*\*Course Information:\*\* ME 7104 includes metals and alloy systems, strengthening mechanisms of metals, iron-carbon alloys, corrosion-resistant alloys, light metals and their alloys, copper and nickel base alloys, super alloys, the function of alloying elements in metals, heat treatments, surface hardening, and surface modification.

\*\*CR:\*\* The former ENGI 6972

\*\*EQ:\*\* The former ENGI 7911

\*\*LH:\*\* At least five 3-hour laboratory sessions per semester

\*\*PR:\*\* ME 5103 or the former ENGI 5911

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303743>

\*\*Course Title:\*\* ME 7105 Welding and Joining Processes

\*\*Course Information:\*\* ME 7105 introduces modern welding and joining processes for metallic materials, polymers, and ceramics. Fundamentals of materials joining processes and the impact of the process parameters on the weld geometry, mechanical properties, and quality are discussed. Laboratory exercises will provide hands-on experience with some industrially significant welding processes.

\*\*EQ:\*\* The former ENGI 8971

\*\*LH:\*\* Seven 3-hour sessions per semester

\*\*PR:\*\* ME 4601 or the former ENGI 4934, ME 5103 or the former ENGI 5911

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303775>

\*\*Course Title:\*\* ME 7203 Instrumentation and Experimental Design

\*\*Course Information:\*\* ME 7203 involves analysis and design of mechanical measurement systems and multi-factor experiments. Topics covered include static and dynamic characteristics of sensors, Fourier transforms, sampling theorem and signal conditioning, uncertainty analysis of sensors, sensors for motion control, load sensing and process control, one factor vs multi-factor experiments, factorial design and analysis, partial factorial design and blocking, response surface methodology (RSM).

\*\*EQ:\*\* The former ENGI 7930

\*\*LH:\*\* At least four 3-hour sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* ENGI 4421 or Statistics 2550, ME 6202 or the former ENGI 6951

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303732>

\*\*Course Title:\*\* ME 7204 Robotics and Automation

\*\*Course Information:\*\* ME 7204 provides the fundamentals in robotic manipulators and arms. The course provides basic understanding in coordinate transformations for spatial description, both kinematical and kinetic analysis, forces and dynamics and finally trajectory generations and path planning.

\*\*CR:\*\* The former ENGI 7944

\*\*EQ:\*\* The former ENGI 7952

\*\*LH:\*\* At least three 3-hour sessions per semester

\*\*PR:\*\* ENGI 4430

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303777>

\*\*Course Title:\*\* ME 7205 Mechatronics II

\*\*Course Information:\*\* ME 7205 emphasizes the integration of the core technologies on which contemporary, mechatronic designs are based. Topics covered include combinational logic circuit design, sequential logic circuit design, modeling and control of servo motors, selection, sizing, and modeling of servo valves and hydraulic actuators, microcontroller technology and interfacing (relays, timers, PWM control, interrupts, digital communication).

\*\*CR:\*\* The former ENGI 5951

\*\*EQ:\*\* The former ENGI 7953

\*\*LH:\*\* Five 3-hour sessions per semester OR tutorial 1 hour per week

\*\*PR:\*\* ME 6202 or the former ENGI 6951

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303771>

\*\*Course Title:\*\* ME 7210 Industrial Automation

\*\*Course Information:\*\* ME 7210 introduces programmable logic controllers (PLC) and ladder logic programming, sensor and actuator interfaces, DC and AC motors, pneumatic circuits, fluid power actuators and control, industrial data communication, supervisory control and data acquisition (SCADA) and human machine interface (HMI).

\*\*LC:\*\* Minimum of 2 lecture hours per week

\*\*LH:\*\* Five 3-hour sessions per semester

\*\*PR:\*\* ME 6202 or the former ENGI 6951, ME 6701 or the former ENGI 6928 or the former ENGI 7928

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303742>

\*\*Course Title:\*\* ME 7220 Guidance, Navigation, and Control

\*\*Course Information:\*\* ME 7220 provides applied knowledge in the design of navigation algorithms used in aerial autonomy, marine robotics, and self-driving applications. Topics covered include modeling platform and sensor dynamics, stochastic processes, linear state space GN&C solutions, nonlinear GN&C solutions, optimal filtering, trajectory optimization, factor graphs, and performance analysis.

\*\*LH:\*\* At least three 3-hour sessions per semester

\*\*PR:\*\* ENGI 4421, ME 6202 or the former ENGI 6951

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303754>

\*\*Course Title:\*\* ME 7230 Introduction to MEMS

\*\*Course Information:\*\* ME 7230 provides the fundamentals in micro-electro-mechanical systems (MEMS) using examples from industrial MEMS applications. Topics include essential electrical and mechanical concepts for MEMS; fabrication processes for MEMS devices; basic MEMS governing equations in different energy domains (mechanical, electrical and thermal); methods for layout, design and modeling of MEMS devices; simulation techniques; techniques for testing and characterization of MEMS devices; thermal sensing and actuation; surface micro machining; and case studies.

\*\*LH:\*\* At least three 3-hour sessions per semester

\*\*PR:\*\* ME 6202 or the former ENGI 6951

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303739>

\*\*Course Title:\*\* ME 7404 Heat Transfer II

\*\*Course Information:\*\* ME 7404 examines advanced topics in heat transfer; multidimensional heat conduction: shape factors, numerical methods, moving heat sources; phase change heat transfer: melting, solidification, condensation, and boiling; natural convection: external flows, internal flows; multimode heat transfer; and environmental radiation.

\*\*EQ:\*\* The former ENGI 7901

\*\*LH:\*\* At least three 2-hour computer laboratory sessions per semester

\*\*PR:\*\* ME 6403 or the former ENGI 6901

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303765>

\*\*Course Title:\*\* ME 7405 Mechanical Equipment

\*\*Course Information:\*\* ME 7405 examines performance characteristics of mechanical equipment; fluid power devices: pipes; valves; turbomachinery: pumps; fans; blowers; compressors; heat transfer devices: heat exchangers; boilers, and cooling towers.

\*\*EQ:\*\* The former ENGI 7903

\*\*LH:\*\* At least four 1.5-hour sessions per semester

\*\*PR:\*\* ME 6403 or PROC 5002 or the former ENGI 5602 or the former ENGI 6901

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303759>

\*\*Course Title:\*\* ME 7503 Gas Dynamics

\*\*Course Information:\*\* ME 7503 begins with an introduction to compressible gas flows, then considers fundamental laws of compressible fluid flow; wave propagation in compressible fluids; isentropic flow of a perfect gas; normal and oblique shock waves; Prandtl-Meyer flows; external compressible flows; flow in ducts, flow with friction (Fanno) and heat transfer (Rayleigh); imperfect gas effects; and measurement of compressible flows.

\*\*EQ:\*\* The former ENGI 8970

\*\*PR:\*\* ME 5502 or the former ENGI 5962

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303735>

\*\*Course Title:\*\* ME 7603 Finite Element Analysis

\*\*Course Information:\*\* ME 7603 includes a review of basic concepts required for FEA, basics of stiffness formulation, direct stiffness method, displacement method, one-dimensional elements, trusses and frames. Topics include 1D fluid and heat transfer elements, automated analysis and modeling concepts, higher-order elements, two-dimensional elements - plane stress and plane strain, introduction to 3D elements, introduction to advanced topics and isoparametric formulation.

\*\*EQ:\*\* The former ENGI 7934

\*\*LH:\*\* 2 OR tutorial 1 hour per week

\*\*PR:\*\* ENGI 4430, ME 5602 or the former ENGI 5931

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303776>

\*\*Course Title:\*\* ME 7703 Mechanical Component Design II

\*\*Course Information:\*\* ME 7703 is a continuation of the ME 6702 course in the analysis and synthesis of machinery, including advanced analysis of machine elements such as clutches, brakes, couplings, journal bearings, and gears. Advanced machine design concepts are examined, such as reliability, optimization, and techniques for stimulating innovative design. A synthesis project involving the machine elements studied is usually included.

\*\*CR:\*\* The former ENGI 6926

\*\*EQ:\*\* The former ENGI 6927, the former ENGI 7929

\*\*LH:\*\* At least five 3-hour computer laboratory sessions per semester

\*\*PR:\*\* ME 6702 or the former ENGI 5927 or the former ENGI 6929

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303749>

\*\*Course Title:\*\* ME 7704 Mechanical Design Project I

\*\*Course Information:\*\* ME 7704 is the first of two capstone design courses in Mechanical Engineering. In this course, mechanical students are organized into small groups or teams, which must complete a design challenge. The project is presented as an open-ended problem statement with specific performance objectives. The system must be designed, prototyped and tested during the semester. Each team is a small consulting firm and is required to document its object planning as well as its design.

\*\*CR:\*\* The former ENGI 7936

\*\*EQ:\*\* The former ENGI 7926

\*\*LC:\*\* Minimum of 2 lecture hours per week

\*\*LH:\*\* At least three 2-hour sessions per semester

\*\*PR:\*\* ENGI 4102, completion of Term 6 of the Mechanical Engineering Program

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303758>

\*\*Course Title:\*\* ME 7705 Mechatronics Design Project I

\*\*Course Information:\*\* ME 7705 provides an opportunity for senior students to integrate the knowledge that they have acquired through the junior terms and apply it to solving a mechatronics engineering design problem. Students work in small teams with the assistance of a faculty mentor to define an appropriate design problem and propose a method of solution to the problem. The project is continued in ME 8706.

\*\*CR:\*\* The former ENGI 7926, the former ENGI 7936

\*\*LC:\*\* At least 10 lecture hours per semester

\*\*LH:\*\* Scheduled as required OR weekly meetings with project supervisor

\*\*PR:\*\* ENGI 4102, completion of Term 6 of the Mechatronics Engineering Program

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303737>

\*\*Course Title:\*\* ME 8106 Corrosion and Corrosion Control

\*\*Course Information:\*\* ME 8106 examines forms of corrosion; the electrochemical nature of the corrosion process; the mixed potential theory, Pourbaix diagrams, and Evan diagrams; corrosion testing, control use by use of materials, selection, cathodic protection, inhibitors, and coatings. There are case studies of selected corrosion problems.

\*\*CR:\*\* The former ENGI 8962

\*\*EQ:\*\* The former ENGI 8911

\*\*LH:\*\* At least four 3-hour sessions per semester

\*\*PR:\*\* ME 5103 or ONAE 4007 or the former ENGI 4007 or the former ENGI 5911

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303772>

\*\*Course Title:\*\* ME 8304 Machine Dynamics

\*\*Course Information:\*\* ME 8304 reviews mechanism kinematics and inverse dynamics (prediction of unknown forces and torques required to create known motion) and continues with forward dynamic analysis of mechanisms (predicting unknown motion due to applied forces and torques) using student-generated computer code and commercial software. Practical applications of dynamics are explored, such as engine shaking forces, balancing of machinery, shaft vibration, design of flywheels, and gyroscopic effects.

\*\*CR:\*\* The former ENGI 7945

\*\*EQ:\*\* The former ENGI 8937

\*\*PR:\*\* ME 4302 or the former ENGI 4932, ME 6303 or the former ENGI 6933

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303736>

\*\*Course Title:\*\* ME 8305 Modelling and Simulation of Dynamic Systems

\*\*Course Information:\*\* ME 8305 emphasizes interdisciplinary system models, equation formulation and structure, and model complexity. The bond graph modeling language will be introduced to simulate systems containing mechanical, electrical, thermal, hydraulic, and magnetic components.

\*\*EQ:\*\* The former ENGI 8946

\*\*PR:\*\* ME 5201 or ECE 5610 or the former ENGI 5952, ME 6303 or the former ENGI 6933

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303752>

\*\*Course Title:\*\* ME 8406 Design of Thermal Systems

\*\*Course Information:\*\* ME 8406 examines thermal system design; modeling of thermal systems; steady and transient system simulation; single and multi-variable optimization; overall system performance; thermodynamic optimization; selected design case studies.

\*\*EQ:\*\* The former ENGI 8903

\*\*PR:\*\* ME 7404 or the former ENGI 7901, ME 7405 or the former ENGI 7903

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303763>

\*\*Course Title:\*\* ME 8407 Sustainable Energy Systems

\*\*Course Information:\*\* ME 8407 examines thermo-fluid features of energy conversion and storage technologies. Topics include nuclear power, wind power, biorenewable and nonconventional fuels, fuel cells, carbon capture and sequestration, photovoltaics, solar thermal, energy storage, and hydroelectric power systems.

\*\*EQ:\*\* The former ENGI 8984

\*\*PR:\*\* ME 4402 or the former ENGI 4901, ME 7404 or the former ENGI 7901

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303746>

\*\*Course Title:\*\* ME 8504 Computational Fluid Dynamics

\*\*Course Information:\*\* ME 8504 begins with a review of the equations governing viscous fluid flows and heat transfer. The course includes heat conduction, convection-diffusion, and fluid flow equations; gridding, dependent variable interpolation, discretized equations, solution of the discretized equations, transients and nonlinearities; testing and validation of CFD codes, standard test problems.

\*\*EQ:\*\* The former ENGI 8947

\*\*PR:\*\* ME 5502 or the former ENGI 5962 or the former ENGI 6961, ME 7404 or the former ENGI 7901

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303774>

\*\*Course Title:\*\* ME 8505 Fluid Structure Interactions

\*\*Course Information:\*\* ME 8505 examines structural vibrations generated by fluid flow. These vibrations can be transient or they can take the form of instability or resonance. The course deals with the following fluid structure interactions: (1) Flow-induced vibration of structures (2) Unsteady flow in pipe networks (3) Water wave interactions with structures.

\*\*CR:\*\* The former ENGI 8904

\*\*EQ:\*\* The former ENGI 8964

\*\*LH:\*\* At least three 3-hour sessions per semester

\*\*PR:\*\* ME 5502 or the former ENGI 5962 or the former ENGI 6961, ME 6303 or the former ENGI 6933

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303756>

\*\*Course Title:\*\* ME 8506 Advanced Fluid Dynamics

\*\*Course Information:\*\* ME 8506 includes fluid kinematics; equations of fluid dynamics: Navier-Stokes equations, Euler's equations, Stokes' equations, vorticity transport; advanced topics in: low Reynolds flows, unsteady viscous flows, boundary layer analysis, potential flows; introduction to turbulent flow; free shear flows.

\*\*EQ:\*\* The former ENGI 8965

\*\*PR:\*\* ME 5502 or the former ENGI 5962 or the former ENGI 6961

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303766>

\*\*Course Title:\*\* ME 8604 Fatigue and Fracture Mechanics

\*\*Course Information:\*\* ME 8604 is an introduction to fatigue and fracture analysis of metallic components, failure mechanisms, fracture mechanisms, effects of cracks, notches, collapse; linear elastic fracture mechanic analysis; design of components to avoid fracture; fatigue crack propagation, fracture initiation, crack arrest; and fracture toughness measurements.

\*\*EQ:\*\* The former ENGI 8933

\*\*OR:\*\* Tutorial 1 hour per week

\*\*PR:\*\* ME 5602 or the former ENGI 5931

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303741>

\*\*Course Title:\*\* ME 8605 Pressure Component Design

\*\*Course Information:\*\* ME 8605 includes pressure vessel design philosophy; membrane theory of shells; stress categories; discontinuous stresses; design of pressure vessel components according to ASME Boiler and pressure vessel and piping codes. There is a design project involving pressure vessel components.

\*\*EQ:\*\* The former ENGI 8935

\*\*OR:\*\* At least 1 tutorial hour per week

\*\*PR:\*\* ME 5602 or the former ENGI 5931, ME 6702 or the former ENGI 6929

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303769>

\*\*Course Title:\*\* ME 8606 Mechanical Behaviour of Composites

\*\*Course Information:\*\* ME 8606 includes stress-strain behavior of composites, properties of matrix and reinforcing materials, mechanics of fiber-reinforced composites, lamina and laminate analysis, and an introduction to manufacturing methods.

\*\*EQ:\*\* The former ENGI 8982

\*\*OR:\*\* Tutorial 1 hour per week

\*\*PR:\*\* ME 5602 or the former ENGI 5931

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303731>

\*\*Course Title:\*\* ME 8705 Mechanical Design Project II

\*\*Course Information:\*\* ME 8705 is the Mechanical Engineering capstone project, building on skills acquired in ME 7704. Student teams choose a unique design challenge and proceed to generate a solution. Problems are often drawn from industry and, where possible, interdisciplinary interaction is encouraged. The problem proponent will act as the "client," and the team is expected to generate a solution. Emphasis is placed on oral and written communication and technical aspects. Wherever possible, elements should be prototyped and tested.

\*\*CR:\*\* The former ENGI 8936

\*\*EQ:\*\* The former ENGI 8926

\*\*LC:\*\* Scheduled as required

\*\*LH:\*\* Scheduled as required

\*\*PR:\*\* ME 7704 or the former ENGI 7926

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303740>

\*\*Course Title:\*\* ME 8706 Mechatronics Design Project II

\*\*Course Information:\*\* ME 8706 continues ME 7705 and provides an opportunity for senior students to integrate the knowledge that they have acquired through the junior terms and apply it to solving a mechatronics engineering design problem. Students work in small teams with the assistance of a faculty mentor to complete detailed design, implementation and testing of a mechatronics engineering system to solve the problem as defined in ME 7705.

\*\*CR:\*\* The former ENGI 8926, the former ENGI 8936

\*\*LC:\*\* Scheduled as required

\*\*LH:\*\* Scheduled as required

\*\*PR:\*\* ME 7705

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303748>

\*\*Course Title:\*\* ME 8801 Production & Operations Management

\*\*Course Information:\*\* ME 8801 is an overview of production and operations management, and an examination of decision making and operations strategy; process design and improvement, process flow analysis/simulation, capacity planning; design of value chains, lean systems, plant layout and process planning; operating value chains, MIS systems, inventory and resource management; Relevant computer laboratory exercises are conducted.

\*\*CR:\*\* The former ENGI 7943

\*\*EQ:\*\* The former ENGI 8945

\*\*PR:\*\* ME 6403 or the former ENGI 6901

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303734>

\*\*Course Title:\*\* ME 8900-8999 Special Topics in Mechanical and Mechatronics Engineering

\*\*Course Information:\*\* ME 8900-8999 will have topics to be studied announced by the Department.

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/4/#d.en.303738>