Ocean and Naval Architecture Engineering at Memorial University of Newfoundland

The full-time 141 credit hour Bachelor of Engineering (Co-operative), Ocean and Naval Architectural Engineering Major, requires eight academic terms and four work terms.

The 141 credit hours shall normally be taken in the academic terms and order as set out in [Ocean and Naval Architectural Engineering Major](https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/6/6/#d.en.328556).

Work terms shall normally be taken in the order as set out in [Ocean and Naval Architectural Engineering Major](https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/6/6/#d.en.328556).

Ocean and Naval Architectural Engineering students may complete a minor in Mathematics as outlined under [Faculty of Science, Mathematics, Minor in Mathematics](https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-science/11/9/#d.en.304031).

Ocean and Naval Architectural 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:

| 0: Regular courses |
| --- |
| 9: Special Topics courses |

Non-departmental Engineering courses are designated by ENGI.

Ocean and Naval Architectural Engineering courses are designated by ONAE.

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

- \*\*Required Courses:\*\*

1. Chemistry 1050 or 1200

2. ENGI 1010, 1020, 1030, 1040

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

4. Mathematics 1000, 1001, 2050

5. Physics 1050, 1051

- Elective Courses:

- Students who are expecting to successfully complete the Engineering One requirements by the end of the Winter semester may apply to undertake a work term during the Spring semester. In this case, the prerequisite course ENGI 200W is expected to be successfully completed during the Fall semester. All other students are expected to successfully complete ENGI 200W in the Winter semester of Engineering One.

- In addition to meeting the requirements outlined below, a student must successfully complete four Complementary Studies courses as described under Description of Program, Complementary Studies.

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

- \*\*Required Courses:\*\*

1. ENGI 3101

2. Mathematics 2000

3. ME 3301, 3401

4. ONAE 3001, 3054

\*\*Winter\*\* -

- \*\*Required Courses:\*\*

1. ENGI 001W or 002W

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

- \*\*Required Courses:\*\*

1. Mathematics 2260

2. ONAE 4002, 4007, 4011, 4020

\*\*Fall\*\* -

- \*\*Required Courses:\*\*

1. ENGI 001W or 002W or 003W

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

- \*\*Required Courses:\*\*

1. Mathematics 3202

2. ONAE 5020, 5022, 5034

3. Physics 3300

\*\*Spring\*\* -

- \*\*Required Courses:\*\*

1. ENGI 002W or 003W or 004W

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

- \*\*Required Courses:\*\*

1. ONAE 6002, 6005, 6036, 6046, 6055

\*\*Winter\*\* -

- \*\*Required Courses:\*\*

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

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

- \*\*Required Courses:\*\*

1. ONAE 7000, 7002, 7033, 7036

- Elective Courses:

- 3 credit hours from ONAE 7003, 7046, PROC 7171, or other courses as specified by the Head of the Department of Ocean and Naval Architectural Engineering

\*\*Fall\*\* -

- \*\*Required Courses:\*\*

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

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

- \*\*Required Courses:\*\*

1. ENGI 8152

2. ONAE 8000

- 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 Ocean and Naval Architectural Engineering.

- 9 credit hours from ENGI 8150, ONAE 8034, 8046, 8054, 8055, 8074, 8075, or other courses as specified by the Head of the Department of Ocean and Naval Architectural Engineering.

\*\*Course Title:\*\* ONAE 3001 Ocean/Naval Design

\*\*Course Information:\*\* ONAE 3001 introduces design and operation for ships and marine structures. Technology evolution in ship and offshore structures is reviewed, emphasizing service needs. Structural concepts, materials, and construction methods are examined, including design for manufacturing. The design spiral and trade-offs between design characteristics are explored, and modeling methods as tools in the design process are introduced. There is a minimum of six laboratory sessions including ship tours, a design project, or research paper.

\*\*EQ:\*\* The former ENGI 3001

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

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303800>

\*\*Course Title:\*\* ONAE 3054 Ocean Engineering Hydrostatics

\*\*Course Information:\*\* ONAE 3054 is an introductory course to naval architecture and marine engineering. It discusses the basic principles of the statics of rigid floating or submerged structures. These include: ships, offshore platforms, and submersibles. Methods of analysis of the hydrostatics, stability and trim, damage stability, and the statics of mooring systems are introduced. Applications are also discussed.

\*\*EQ:\*\* The former ENGI 3054

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

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

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303802>

\*\*Course Title:\*\* ONAE 4002 Mechanics of Solids for Marine Structures

\*\*Course Information:\*\* ONAE 4002 introduces mechanical properties of materials and stress/strain analysis. These concepts are applied to the design and analysis of bars, beams, and built-up ship frames in axial tension/compression, torsion, shear, and bending. In particular, the concepts of plane stress, plane strain, stress and strain transformations in two dimensions, Mohr’s circle, and shear force and bending moment diagrams are examined. Elastic column buckling and the design of hull structures are also introduced.

\*\*CO:\*\* ONAE 4007

\*\*CR:\*\* CIV 4310, ME 4601, the former ENGI 4312, the former ENGI 4934

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

\*\*OR:\*\* Up to ten 1-hour tutorials per semester

\*\*PR:\*\* ENGI 1010, ONAE 3001

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.314294>

\*\*Course Title:\*\* ONAE 4007 Marine Materials

\*\*Course Information:\*\* ONAE 4007 examines the properties and uses of steel, aluminum, and composite materials in marine applications. Topics include: review of mechanics of materials, Hooke’s Law, material failure models; carbon steel - fundamentals, processes, preparation, design, drawings, certification; joining of aluminum; riveting and welding; corrosion phenomena; composites - classification, production, and mechanical properties.

\*\*CR:\*\* The former ENGI 7007

\*\*EQ:\*\* The former ENGI 4007

\*\*LH:\*\* At least 4 three-hour sessions per semester

\*\*PR:\*\* Chemistry 1050 or Chemistry 1200, ENGI 1010, ONAE 3001 or the former ENGI 3001

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303805>

\*\*Course Title:\*\* ONAE 4011 Resistance and Propulsion

\*\*Course Information:\*\* ONAE 4011 examines ship resistance and some factors considered in the design of marine screw propellers. Topics include the resistance due to friction, wave making, form appendage, wind and waves, squat, blockage, shallow water effects, and the estimation of powering using methodical series and statistical methods. Topics considered in the design of marine screw propellers include propeller theory, blade sections, blade strength, methodical series charts, efficiency elements, lifting line calculations, cavitation, and propellers in non-uniform flow.

\*\*CR:\*\* The former ENGI 5011

\*\*EQ:\*\* The former ENGI 4011

\*\*LH:\*\* 3

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

\*\*PR:\*\* ONAE 3054 or the former ENGI 3054

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303799>

\*\*Course Title:\*\* ONAE 4020 Marine Fluid Dynamics

\*\*Course Information:\*\* ONAE 4020 includes fluid statics; fluid flow phenomena, in general and in marine applications; control volume analysis of fluid motion; conservation of mass, momentum and energy; differential approach to flow analysis; head losses; applications of conservation laws; external vs. internal flow; dimensional analysis and scaling; fluid-structure interaction concepts; potential flow theory, lift and Kutta-Joukowski theorem; viscous flow, boundary layers and drag.

\*\*CR:\*\* Mathematics 4180, Physics 4205

\*\*EQ:\*\* The former ENGI 4020

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

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

\*\*PR:\*\* ONAE 3054 or the former ENGI 3054

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303804>

\*\*Course Title:\*\* ONAE 5020 Marine Propulsion

\*\*Course Information:\*\* ONAE 5020 is a second course in marine propellers and ship powering. Design and analysis of marine screw propellers and other propulsion devices are covered. Conventional and unconventional propulsion systems are introduced. Methods and philosophy of propeller design are included. Design of fixed-pitch propellers based on lifting line theory and the design of ducted propellers are emphasized. Design of other propulsion systems such as waterjets and sails is also incorporated.

\*\*CR:\*\* The former ENGI 6020

\*\*EQ:\*\* The former ENGI 5020

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

\*\*PR:\*\* ONAE 4011 or the former ENGI 4011, ONAE 4020 or the former ENGI 4020

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303796>

\*\*Course Title:\*\* ONAE 5022 Probability and Random Processes in Ocean Engineering

\*\*Course Information:\*\* ONAE 5022 includes basic concepts in probability, random variables, multiple random variables, descriptive statistics. The random processes component reviews mathematics of functions; introduces system input-output relations of continuous-time systems; contrasts time vs frequency domain representations; introduces frequency response plots and the Fourier transform. A probabilistic approach to ship damage, representation of ocean waves (in time and frequency domains), Response Amplitude Operators (RAO), and acceptable levels of risk for design are introduced and applied.

\*\*EQ:\*\* The former ENGI 5022

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

\*\*PR:\*\* Mathematics 2260 or the former Mathematics 3260, ONAE 3001 or the former ENGI 3001

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303783>

\*\*Course Title:\*\* ONAE 5034 Marine Vibrations

\*\*Course Information:\*\* ONAE 5034 provides an introduction to mechanical vibration with a focus on vibration of marine machinery and on the dynamic response of marine structures. Topics include: single degree of freedom systems – free vibration, energy methods, response to harmonic excitation, response to arbitrary inputs; multi degree of freedom systems – natural frequencies and mode shapes, response to harmonic excitation; frequency response functions; on-board sources of vibration, vibration measurement techniques and instrumentation.

\*\*CR:\*\* The former ENGI 5932, the former ENGI 6933, ME 6303

\*\*EQ:\*\* The former ENGI 5034

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

\*\*PR:\*\* Mathematics 2260, ME 3301 or the former ENGI 3934

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303788>

\*\*Course Title:\*\* ONAE 6002 Ship Structures I

\*\*Course Information:\*\* ONAE 6002 examines longitudinal strength, still water and wave bending moment, shear and bending moment curves, Smith Correction, section modulus calculation, torsion and racking forces; bulkhead and girder scantlings, portal frame analysis by moment distribution and energy method; finite element analysis and the use of Classification Society rules for design of midship section. Laboratory sessions cover use of analysis software to illustrate structural behaviour concepts.

\*\*CR:\*\* The former ENGI 5003

\*\*EQ:\*\* The former ENGI 6002

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

\*\*PR:\*\* CIV 4310 or the former ENGI 4312, ONAE 4007 or the former ENGI 4007 or the former ENGI 7007

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303797>

\*\*Course Title:\*\* ONAE 6005 Floating Ocean Structures Design

\*\*Course Information:\*\* ONAE 6005 introduces floating structures used in the offshore petroleum industry, along with functional requirements, such as drilling and production, of the platforms. Field development criteria are discussed in the context of platform concept selection and synthesis. Environmental loads are examined, focusing on wave loads and ice loads. Diffraction theory and its application on offshore structures are presented. Offshore safety is discussed in terms of major hazards, risk management, and case studies.

\*\*CR:\*\* The former ENGI 7005

\*\*EQ:\*\* The former ENGI 6005

\*\*LH:\*\* 1

\*\*PR:\*\* ONAE 3001 or the former ENGI 3001, ONAE 3054 or the former ENGI 3054

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303794>

\*\*Course Title:\*\* ONAE 6036 Dynamics of Ocean Vehicles

\*\*Course Information:\*\* ONAE 6036 examines applications of the linearized equations of motion to ocean vehicle problems with single and multiple degrees of freedom in waves; dynamics of marine vehicles: motions in waves; hydrodynamics effects such as added mass, radiation and viscous damping; strip theory; irregular seaway and motions.

\*\*CR:\*\* The former ENGI 6030, the former ENGI 7035

\*\*EQ:\*\* The former ENGI 6036

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

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

\*\*PR:\*\* ONAE 4020 or the former ENGI 4020, ONAE 5022 or the former ENGI 5022, ONAE 5034 or the former ENGI 5034 or the former ENGI 5932 or the former ENGI 6933 or ME 6303

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303784>

\*\*Course Title:\*\* ONAE 6046 Marine Engineering Systems

\*\*Course Information:\*\* ONAE 6046 examines shafting system design; shafting system vibration analysis, study of exciting forces and moments, and balancing of reciprocating and rotating machinery; heat transfer and marine heat exchangers; incompressible fluid flow and piping system design and selection of appropriate pumping devices.

\*\*EQ:\*\* The former ENGI 6046, the former ENGI 7045

\*\*LH:\*\* 1

\*\*PR:\*\* ME 3401 or the former ENGI 3901, ONAE 5034 or the former ENGI 5034

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303801>

\*\*Course Title:\*\* ONAE 6055 Marine Cybernetics

\*\*Course Information:\*\* ONAE 6055 examines propulsion and motion control of ships, submersibles and offshore structures. Building upon the student’s knowledge of mathematics, mechanics and hydrodynamics provides an introduction to control systems and mathematical modeling of marine systems. Course components include: basic control actions and response of control systems; simulation and design of control systems; dynamic positioning; power management; marine automation.

\*\*EQ:\*\* The former ENGI 6055

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

\*\*PR:\*\* ONAE 4011 or the former ENGI 4011, ONAE 5034 or the former ENGI 5034 or the former ENGI 5932 or the former ENGI 6933 or ME 6303

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303778>

\*\*Course Title:\*\* ONAE 7000 Ocean Systems Design

\*\*Course Information:\*\* ONAE 7000 develops concept design methods for marine systems from need definition through to solution selection, including weight, cost and power requirements estimating, selection of principal design characteristics and evaluation of alternative solutions. Students develop a proposal for a marine system design project which will include a statement of requirements, a parametric study, a work plan and schedule. This design project will be completed as a full design in ONAE 8000.

\*\*CR:\*\* The former ENGI 7052

\*\*EQ:\*\* The former ENGI 7000

\*\*LH:\*\* 3

\*\*PR:\*\* ENGI 4102, completion of Academic Term 6 of the Ocean and Naval Architectural Engineering program

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303792>

\*\*Course Title:\*\* ONAE 7002 Ship Structures II

\*\*Course Information:\*\* ONAE 7002 is an introduction to ship structural safety and rational design. Topics include local strength analysis, elastic, plastic and ultimate strength of plating, frames and grillages, buckling of plates/grillages and fatigue and fracture in ships. Laboratory exercises include structural analysis software and physical experiments.

\*\*EQ:\*\* The former ENGI 6003, the former ENGI 7002

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

\*\*PR:\*\* ONAE 5022 or the former ENGI 5022, ONAE 6002 or the former ENGI 6002 or the former ENGI 5003

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303786>

\*\*Course Title:\*\* ONAE 7003 Small Craft Design

\*\*Course Information:\*\* ONAE 7003 presents fundamentals of naval architecture and design methodology for small craft. Emphasis is on recreational craft, with special emphasis on sailing vessels. Construction materials, scantlings, performance prediction and seaworthiness are covered. Design problems unique to small craft such as mast design, sail area determination and performance prediction are covered. Students will do a small craft design of their choice. Small weekly design studies will be required.

\*\*EQ:\*\* The former ENGI 7003, the former ENGI 8003

\*\*PR:\*\* Completion of Academic Term 6 of the Ocean and Naval Architectural Engineering program

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303803>

\*\*Course Title:\*\* ONAE 7033 Marine Hydrodynamics

\*\*Course Information:\*\* ONAE 7033 examines the fundamental equations of hydrodynamics, boundary layers; potential flow, added mass, damping, circulation, and vorticity; numerical methods for hydrodynamic coefficients; water waves and loading for regular and irregular seas.

\*\*EQ:\*\* The former ENGI 7033

\*\*LH:\*\* At least one 3-hour session per semester

\*\*OR:\*\* One tutorial hour per week

\*\*PR:\*\* Mathematics 3202, ONAE 5020 or the former ENGI 5020 or the former ENGI 6020

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303795>

\*\*Course Title:\*\* ONAE 7036 Manoeuvring of Ocean Vehicles

\*\*Course Information:\*\* ONAE 7036 examines manoeuvrability of ocean vehicles; derivation of linear and nonlinear equations of motion and hydrodynamic coefficients; stability of motion; standard maneuvers such as turning circle, turning spiral, and PMM test; modelling and simulations of engine, propulsion, rudder and transmission systems during manoeuvring; systems for course keeping, autopilot, motion control and dynamic positioning.

\*\*CR:\*\* The former ENGI 6030, the former ENGI 7035

\*\*EQ:\*\* The former ENGI 7036

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

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

\*\*PR:\*\* ONAE 6036 or the former ENGI 6036

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303789>

\*\*Course Title:\*\* ONAE 7046 Ship Production Management

\*\*Course Information:\*\* ONAE 7046 examines management and business models for shipyards and relationships with ship owners. Reviews development of related worker skills and technologies and introduces project management methods needed to construct ships in a timely and cost-effective way. Considers contracts, trade union collective agreements and health and safety requirements. May include invited guest lectures from practicing industry professionals. Focus is on a wide range of topics including shipyard operations, classification societies, and other service industries related to shipbuilding.

\*\*EQ:\*\* The former ENGI 7046

\*\*PR:\*\* ENGI 4102, ONAE 5022 or the former ENGI 5022

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303787>

\*\*Course Title:\*\* ONAE 8000 Ocean and Naval Architectural Engineering Project

\*\*Course Information:\*\* ONAE 8000 completes the design project selected and approved in ONAE 7000 The project must illustrate the application and integration of previous design related courses, i.e., decision methods, impact assessments and application of technology. The subject may be ship or offshore structure design, marine system, directed research or a unique design solution. Lectures will be scheduled as required.

\*\*EQ:\*\* The former ENGI 8000

\*\*LH:\*\* 3

\*\*PR:\*\* ONAE 7000 or the former ENGI 7000

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303793>

\*\*Course Title:\*\* ONAE 8034 Applied Acoustics

\*\*Course Information:\*\* ONAE 8034 provides an introduction to acoustic engineering. Topics include: sound in fluids and solids, wave phenomena, mathematical models of sound waves, sources of sound, frequency analysis, levels and decibels, introduction to psychoacoustics, sound waves in rooms, reverberation time, sound absorbers, sound insulation, room acoustical design, introduction to underwater acoustics, acoustic measurement techniques and instrumentation.

\*\*EQ:\*\* The former ENGI 8034

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

\*\*PR:\*\* ONAE 5034 or the former ENGI 5034

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303791>

\*\*Course Title:\*\* ONAE 8046 Marine Engineering II

\*\*Course Information:\*\* ONAE 8046 builds on the fundamental marine engineering aspects covered in ONAE 6046 to include engineering factors onboard the ship, such as electrical generation, lighting, heating and air conditioning, as well as special systems needed on board the ship for operation, cargo management and navigation.

\*\*EQ:\*\* The former ENGI 8046

\*\*PR:\*\* ONAE 6046 or the former ENGI 6046

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303785>

\*\*Course Title:\*\* ONAE 8054 Advanced Marine Vehicles

\*\*Course Information:\*\* ONAE 8054 examines the concepts used in the design of advanced marine vehicles. Emphasis will be given to: structural design of craft constructed from fibre reinforced plastics; high speed marine vehicles (powering, structures, seakeeping and model testing); small craft.

\*\*EQ:\*\* The former ENGI 8054

\*\*LH:\*\* At least 9 hours per semester

\*\*PR:\*\* ONAE 6002 or the former ENGI 5003 or the former ENGI 6002

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303781>

\*\*Course Title:\*\* ONAE 8055 Design and Control of Unmanned Marine Vehicles

\*\*Course Information:\*\* ONAE 8055 examines the formulation of mission statement and design constraints of unmanned marine vehicles, surface and underwater. Major subsystems, including propulsion, power, communication, navigation and control, are introduced. Principles of navigation and control as they pertain to unmanned systems are examined. This course includes hands-on experimentation including the design of a small unmanned platform for tank experiments.

\*\*EQ:\*\* The former ENGI 8055

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

\*\*PR:\*\* ONAE 6055 or the former ENGI 6055 or approval of the instructor

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303790>

\*\*Course Title:\*\* ONAE 8074 Arctic Ocean Engineering

\*\*Course Information:\*\* ONAE 8074 examines marine ice load on ships and marine structures designed for ice covered waters. Topics include types of naturally occurring ice; sea ice formation and characteristics; mechanical strength of sea ice under common modes of ice failure; modes of ice interaction with ships and marine structures; estimation of ice forces on offshore structures; powering requirements for ice breaking ships; regulations and standards for design of ships and offshore structures in arctic environments.

\*\*EQ:\*\* The former ENGI 8074, the former ENGI 8674

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

\*\*PR:\*\* CIV 4310 or the former ENGI 4312, ME 3301 or the former ENGI 3934

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303782>

\*\*Course Title:\*\* ONAE 8075 Finite Element Analysis of Marine Structures

\*\*Course Information:\*\* ONAE 8075 examines the application of the finite element method (FEM) to the design and assessment of marine hull structures. Simulation of static, quasi-static, and impact loads on hull structures is discussed. Linear and nonlinear analyses are explored. Practical considerations for finite element model design are discussed.

\*\*EQ:\*\* The former ENGI 8075

\*\*LH:\*\* 12 weekly 3-hour lab sessions

\*\*PR:\*\* ONAE 7002 or the former ENGI 7002 or the former ENGI 6003

\*\*Course Link:\*\* <https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-engineering-and-applied-science/11/5/#d.en.303779>

\*\*Course Title:\*\* ONAE 8900-8999 Special Topics in Ocean and Naval Architectural Engineering

\*\*Course Information:\*\* Special Topics in Ocean and Naval Architectural Engineering (ONAE) 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/11/5/#d.en.303780>