MARINE ENGINEERING TECHNOLOGY

Program Outline

Major: MTCY
Length: 3 Years
Delivery: 6 Semesters, plus 2 work terms
Credential: Ontario College Advanced Diploma, Co-op
Effective: 2018-2019
Location: Owen Sound
Start: Fall (Owen Sound)

Description
This program is an internationally recognized co-operative marine engineering cadet program designed in co-operation with Transport Canada Marine Safety and Security (TCMSS) and Canada’s shipping companies. Students focus on developing competencies required to function as part of a shipboard marine engineering team. Content includes, and is based upon, the TCMSS Engineering Officer Education Training (EOET) program requirements.

The final two semesters are open to anyone holding an STCW Reg. III/1 Marine Engineer Certificate of Competency. These students can apply for advanced standing exempting them from the first two years of the program. Upon completion of semesters five and six, they may be exempted from written examinations for 2nd and Chief Engineer Officer.

NOTE: This is a TCMSS approved program.

Career Opportunities
Graduates are educated and trained to become marine engineer officers of the watch. They may find a rewarding career as a ship’s engineering officer on board commercial vessels such as bulk carriers, tugs, ferries, tankers, cruise ships, coast guard and fishing vessels throughout Canada and the world. This program may also lead to positions of
leadership in the marine industry. Graduates may earn academic exemptions and credentials to advance to Chief Engineer pending further shipboard experience and higher level short training courses.

**Program Learning Outcomes**
The graduate has reliably demonstrated the ability to:

- use principles of leadership, team management and conflict resolution expectant of a marine engineering officer at the operational and management levels;
- lead and manage effective operational teams whose goal is to transport cargo in a safe and environmentally sustainable manner;
- perform all work in accordance with legislation, regulation, policies and practices related to health and safety, accessibility, human rights and environmental management;
- evaluate the power plant performance and efficiencies through charting and trending and participate in the installation and maintenance of marine equipment and systems;
- operate and maintain equipment safely using handbooks, catalogues, manufacture’s specifications, checklists, and legislative codes;
- interpret installation drawings, assembly drawings and detail drawings and compile technical specifications;
- integrate electro-technology, electronics and electrical equipment in the operation of alternators, generators, AC and DC motors;
- use senior engineering management principles during normal and abnormal operations of marine vessels;
- apply computer skills to conduct daily power plant operations at the operational and management level;
- analyze basic entrepreneurial strategies used to identify and respond to new opportunities.

**Practical Experience:**
Co-operative Education is a mandatory component of all Co-op programs at Georgian College; it has been designed as a process by which students integrate their academic education with work experience related to their programs of study. This integration affects much more than simply earning a salary, including the adjustment to the work environment and the development of professionalism. It also reinforces skills and theory learned during academic semesters, develops professional contacts, job knowledge and career path, improves human relations and communication skills, and promotes personal maturity and financial independence.

Students are requested to register, attend and participate in their scheduled co-operative education classes. These classes are scheduled for all first year students and are expected to be completed in order for students to proceed successfully to their first co-op work experiences. To ensure students are eligible to proceed onto any co-op work experience,
students should refer to Promotional Status and Eligibility for Co-op as outlined in the College Calendar. Co-op policies and procedures can be located on our website: www.georgiancollege.ca/student-services/co-op-and-career-services/students-tab/

Georgian College follows the Co-operative Education guidelines set out by the Canadian Association for Co-operative Education (CAFCE) and Education at Work Ontario (EWO) by supporting the learning outcomes designed for the program specific graduate profile and curriculum as set out by the Ministry of Training, Colleges and Universities.

External Recognition:
This program is accredited by the Canadian Association for Co-operative Education.

The Program Progression:
Fall Intake - Owen Sound

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Summer
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Articulation:
A number of articulation agreements have been negotiated with universities and other institutions across Canada, North America and internationally. These agreements are assessed, revised and updated on a regular basis. Please contact the program co-ordinator for specific details if you are interested in pursuing such an option. Additional information can be found on our website at http://www.georgiancollege.ca/admissions/credit-transfer/

Admission Requirements:
OSSD or equivalent with
- Grade 12 English (C or U)
- Grade 12 Mathematics (C or U)

Note: Applicants must provide a valid Transport Canada Marine Medical stating "fit for sea service" or "fit for sea service with limitations". In the case of an applicant with a certificate "fit for sea service with limitations", the application will be reviewed for admission.
For advanced standing entry into the 3rd year (Semester 5 and 6) of the program, the following additional requirements apply:
- Graduates of a Marine Engineering Cadet Training Program in Canada, (Georgian METC graduates meet this requirement), or
- holders of a Certificate of Competency as a Marine Engineer issued under the STCW Convention, or
- equivalent level of knowledge demonstrated through an interview and portfolio of experience

Mature students, non-secondary school applicants (19 years or older), and home school applicants may also be considered for admission. Eligibility may be met by applicants who have taken equivalent courses, upgrading, completed their GED, and equivalency testing. For complete details refer to: www.georgiancollege.ca/admissions/policies-procedures/

Applicants who have taken courses from a recognized and accredited post-secondary institution and/or have relevant life/learning experience may also be considered for admission; refer to the Credit Transfer Centre website for details: www.georgiancollege.ca/admissions/credit-transfer/

**Additional Information:**
This is a fully integrated co-operative education program, wherein the cadet will participate in semesters of academic study at the Owen Sound Campus, interspersed with work term placements onboard ships. Hence, undergraduates are involved in work activities directly related to their educational objectives.

Every effort is made to arrange work term placements, however, cadets must qualify for such and no guarantee of placement can be made.

Canadian flagged ships only accept Canadian Citizens or Permanent Residents for employment. International students are encouraged to investigate Co-op opportunities prior to commencing studies. Cadets may be subjected to adverse environmental conditions while on board ship (noise, dirt, dust, confined quarters and heavy lifting). Anyone with known allergies should consult with the Co-op department.

International applicants must sign a letter to acknowledge that Transport Canada does not issue Marine Certificates of Competency (Marine Licence) to non-Canadians.
Eligibility to enter the U.S.
Although not a Georgian College admission requirement, all shipping companies, whether Canadian or foreign, which have vessels trading in U.S. ports, require that all their shipboard personnel be eligible to legally enter the U.S.

TCMSS Certification
Students interested in obtaining the TCMSS engineering certificates must comply with their legal requirements as described in the Canada Shipping Act Marine Personnel Regulations. These include proof of Canadian citizenship or proof of permanent resident status and a valid marine medical certificate.

Marine Emergency Duties, Propulsion Plant Simulator, and Maritime Security courses are also requirements for certification by TCMSS. These courses are provided at Georgian College at an extra fee.

**Graduation Requirements:**
43  Mandatory Courses
2   Communications Courses
2   Co-op Work Terms

**Graduation Eligibility:**
To graduate from this program, a student must attain a minimum of 60% or a letter grade of P (Pass) or S (Satisfactory) in each course in each semester. The passing weighted average for promotion through each semester, from year to year, and to graduate is 60%.

Mandatory Courses
CHEM1006    Fuel Combustion Chemistry
CHEM1007    Industrial Chemistry
ELEC1008    Basic Electrical Engineering
ELEC2019    Thermodynamics
ELEC2020    Advanced Electrical Engineering
ELEC2021    Shipboard Electrical Knowledge and Skills
ENGN1001    Basic Engineering Science
ENGN1002    Basic Control Engineering
HRAC2002    Refrigeration and Air Conditioning
HRAC2003    Shipboard Refrigeration and Air Conditioning
MARE1040    Marine Engine Plants
MARE1041    Marine Steam Plants
MARE1043    Marine Systems and Components Blueprint
MARE1044    Marine Plant Energy Distribution
MARE1045    Hydraulics and Pneumatics
MARE1046    Ship Construction for Engineers
MARE1050  Marine Auxiliary Systems
MARE2019  Computer Applications and Networks
MARE2032  Advanced Marine Power Plants
MARE2033  Advanced Marine Power Plants Steam
MARE2034  Shipboard Materials
MARE2035  Marine Power Plant Watchkeeping
MARE2036  Shipboard Power Plant Studies
MARE2037  Shipboard Control Strategies
MARE2038  Stability
MARE3020  Ships Master’s Business for Engineers
MARE3032  Leadership and Teamwork
MARE3040  Electrical Machines Management 1
MARE3041  Advanced Applied Mechanics
MARE3042  Power Plant Auxiliaries Management
MARE3043  Automation and Controls 1
MARE3044  Steam Plant Management
MARE3045  Electrical Machines Management 2
MARE3046  Advanced Thermodynamics
MARE3047  Automation and Controls 2
MARE3048  Naval Architecture
MARE3049  Motor Plant Management
MARE3050  Ship's Business and Maritime Law
MATH1018  Introduction to Technical Mathematics
MATH1019  Technical Mathematics
MCHN2000  Machining
MENG1018  Basic Applied Mechanics
WETC2000  Welding

Communications Courses
To be selected at time of registration from the College list, as determined by testing.

Co-op Work Terms
COOP1032  Marine Engineering Work Term 1
COOP2030  Marine Engineering Work Term 2

Course Descriptions:
CHEM1006  Fuel Combustion Chemistry  32.0 Hours
Students are provided a basic knowledge of marine fuels and lubricants. They learn about fuels used on board a vessel and what happens when a fuel is combusted. Calculations are made to determine the products of combustion and compared to actual sampled data. Chemical properties of lubricating oil with their additives are researched.
CHEM1007 Industrial Chemistry   32.0 Hours  
Students continue the study of chemistry covering topics including mixtures, solutions, boiler water chemistry, corrosion, and alkalinity. They learn fundamentals of atom structures, acidity, alkalinity, corrosion, and water testing and treatment relating to marine boilers and engines.

COOP1032 Marine Engineering Work Term 1   840.0 Hours  
Students work and live onboard ships where they will develop the skills required to become a marine engineer. This is the first of two Co-op sea terms. Students are expected to be involved in learning about the vessel's operations, the command structure and safety procedures. In this course the student is to commence work on a cadet training record book and complete two onboard courses. The focus for this phase is shipboard and personal safety.

COOP2030 Marine Engineering Work Term 2   840.0 Hours  
This is the second of two Co-op sea terms. Students continue their experiential learning and skills development with the goal of becoming a marine engineer. During this sea term students are required to complete their training record book and complete two more onboard courses. The focus for this phase is shipboard operations.

ELEC1008 Basic Electrical Engineering   64.0 Hours  
Students learn basic electrical engineering principles. Topics include circuit theory, electronics, alternating current theory, induction, motors, cabling, batteries and shipboard applications.

ELEC2019 Thermodynamics   64.0 Hours  
Students gain knowledge of how energy in motion can put matter in motion. They learn about and study how energy flows from one form to another is investigated in relation to ship board systems and processes.

ELEC2020 Advanced Electrical Engineering   96.0 Hours  
Students continue and deepen their studies into electrical systems on board ships. They learn about construction and practical operations of DC and AC equipment including transformers, generators, and motors with hands on work in the lab.

ELEC2021 Shipboard Electrical Knowledge and Skills   96.0 Hours  
During this online course, students complete a list of shipboard electrical installation and maintenance projects. These projects are submitted electronically for evaluation. The course material supplements the engineering knowledge presented in the student’s Transport Canada Training Record Book.

ENGN1001 Basic Engineering Science   64.0 Hours
Students learn about dynamics, energy, fluids, heat and Newton’s laws. They solve problems relating to speed, distance and time, friction, energy forms, fluids, and basic thermodynamics heat concepts and calculations.

ENGN1002 Basic Control Engineering  96.0 Hours
Modern ships are highly automated and it is vital that a marine engineer understand how automation works. Students learn about the fundamentals of control theory and practice what they learn in the propulsion plant lab.

HRAC2002 Refrigeration and Air Conditioning  48.0 Hours
Students study the theory of refrigeration and air conditioning systems. They gain knowledge of refrigerants, lubrication, system components, operation and maintenance procedures.

HRAC2003 Shipboard Refrigeration and Air Conditioning  16.0 Hours
During this shipboard course, students complete a list of shipboard refrigeration and air conditioning projects while working on their second work term. These projects are submitted electronically for evaluation. The course material supplements the engineering knowledge presented in the student’s Transport Canada Training Record Book.

MARE1040 Marine Engine Plants  64.0 Hours
Understanding the working cycles, components and thermodynamics of a diesel engine is important in the safe operation of a vessel. Students learn about engine plant preparation, operation, construction, and fault detection necessary to prevent damage. They study thermodynamic heat-engine cycles for most common engine types. This course combines classroom studies and projects in the propulsion plant lab relating to diesel engines.

MARE1041 Marine Steam Plants  64.0 Hours
A thorough understanding of the working cycles and components of a steam powered propulsion plant is important. Students learn auxiliary steam boiler construction and operation, and fault detection necessary to prevent damage. This course combines classroom studies and propulsion plant lab projects to teach this material.

MARE1043 Marine Systems and Components Blueprint  32.0 Hours
Students learn the basics of line constructing, projections, purpose of drawings, views, development of basic 3 dimensional shapes and dimensioning. They also learn to interpret existing drawings relating to hydraulics, pneumatics, electronics, electrical power distribution, engine systems, and supplied manufacturers' data.

MARE1044 Marine Plant Energy Distribution  112.0 Hours
This course is about energy within marine plant systems. Students combine thermodynamic principles, shipboard system operations and basic electrical theory learned in the classroom with experiential learning in the engine room simulator.

MARE1045 Hydraulics and Pneumatics  32.0 Hours
Students obtain a comprehensive grounding in basic hydraulic and pneumatic principles. They learn about construction and operation of hydraulic and pneumatic equipment as used in shipboard applications such as controllable pitch propellers, mooring winches, start air systems, etc.

MARE1046 Ship Construction for Engineers  48.0 Hours
Many types of ships sail the waters of the world. The basic principles of ship construction are the same for all. Students study the principles of ship structures, the materials used in ship construction and the processes of building a ship. This helps in the understanding of the stresses which a ship must withstand due to inclement weather and the loading of a ship.

MARE1050 Marine Auxiliary Systems  80.0 Hours
Students learn about shipboard auxiliary systems and equipment. They transfer knowledge gained in the classroom to use in the propulsion plant lab exercises where studies include pumps, heat exchangers, water production equipment, purifiers, steering gear, deck equipment, oily water separators etc.

MARE2019 Computer Applications and Networks  48.0 Hours
Students are introduced to computer hardware and applications that may be used on modern vessels. They learn about computer operating systems and languages; troubleshooting hardware and software problems; and common computer applications on ships.

MARE2032 Advanced Marine Power Plants  144.0 Hours
In this course in motor and auxiliary systems engineering, students engage in a combination of classroom studies and propulsion plant lab projects. They learn large-bore engine details, medium speed engine details, engine types, and operation and principles.

MARE2033 Advanced Marine Power Plants Steam  80.0 Hours
In this course, students focus on steam power plants. Students learn propulsion steam boiler construction and operation, turbine construction and operation and fault detection necessary to prevent damage. They combine classroom studies with propulsion plant lab projects while learning the material.

MARE2034 Shipboard Materials  64.0 Hours
Students learn about material identification, and selection as needed for on-board maintenance and repair. They study physical ferrous and non-ferrous metals. The also
learn about heat treatment, temperature induced stresses, Hooke’s law, stress and strain relationships, vibration, bonding methods and adhesives.

MARE2035 Marine Power Plant Watchkeeping   32.0 Hours
Students learn and practice the skills necessary to stand an engineering watch during this course. The course is taught using the Propulsion Plant Simulator where students prepare a ship’s power plant for operation and stand a watch while in operational mode practicing watchkeeping skills and proper communications.

MARE2036 Shipboard Power Plant Studies   64.0 Hours
Students complete a list of shipboard projects dealing with power plant arrangements, standard operating procedures, watchkeeping duties, safety systems, and ship construction while working on their first co-op work term. These projects are submitted electronically for evaluation. The course material supplements the engineering knowledge presented in the student’s Transport Canada Training Record Book.

MARE2037 Shipboard Control Strategies   48.0 Hours
Students complete a list of shipboard automation and controls projects while working on their first work term. These projects are submitted electronically for evaluation. The course material supplements the engineering knowledge presented in the student’s Transport Canada Training Record Book.

MARE2038 Stability   48.0 Hours
Students learn about basic ship stability theory, definitions and forces that keep a ship floating upright. In this course, students practice calculations related to the effects of loading a weight on a ship’s centre of gravity, hydrostatics, co-efficient of form and Simpson’s rules for determining areas and volumes, and moments of inertial.

MARE3020 Ships Master’s Business for Engineers   64.0 Hours
In this course, students are provided a broad introduction to the business and regulatory regime of the marine industry. Students study the international and domestic rights, responsibilities and regulations of every seafarer, as well as safety, health and marine pollution prevention. Cargo and insurance requirements and documentation, operational, financial and project management are all discussed in detail.

MARE3032 Leadership and Teamwork   32.0 Hours
This course is designed to blend theoretical and practical skills necessary to be an effective shipboard leader. As a leader, a large part of your responsibility is anticipating issues and implementing directives and standard operating practices. Students learn tools and management techniques to manage workload and resources, assess situations and manage risk within a team environment.

MARE3040 Electrical Machines Management 1   80.0 Hours
Students learn about electrical, electronic and control engineering. Topics include electronics, power electronics, electrical theory, AC machines, and their practical application on board a vessel. High Voltage systems are introduced including safety, testing and reading HV circuit diagrams.

MARE3041 Advanced Applied Mechanics 64.0 Hours
Students obtain a deeper comprehension and knowledge of general mechanics, fluid mechanics, balancing, vibration, stress and strain, torsion, as they relate to shipboard systems and structures. They will practice complex multistep mathematical problem solving calculations related to the course material.

MARE3042 Power Plant Auxiliaries Management 144.0 Hours
Students learn safe working practices and management concepts for auxiliary systems. They also learn about efficient and safe operation and maintenance of auxiliaries in a power plant, detection and identification of machinery faults, inspection and adjustment of equipment as per Classification Society and other statutory requirements.

MARE3043 Automation and Controls 1 80.0 Hours
In this course, students are presented material relating to electrical, electronic and control engineering at a senior engineering level. Students learn about system configuration of automatic control systems and review the fundamentals of process control, AC motor control and hydraulic and pneumatic control circuits.

MARE3044 Steam Plant Management 96.0 Hours
Students learn safe working practices and steam plant management concepts. They also learn about efficient and safe operation and maintenance of the steam power plant, detection and identification of machinery faults, inspection and adjustment of equipment as per Classification Society and other statutory requirements.

MARE3045 Electrical Machines Management 2 64.0 Hours
Students continue studying electrical, electronic and control engineering. They also learn about design, operation and maintenance of High Voltage installations and troubleshooting of electrical equipment faults.

MARE3046 Advanced Thermodynamics 80.0 Hours
Students learn about the thermodynamic analysis of heat engines, heat transfer and refrigeration systems. The course is based on the fundamental thermodynamic concepts and analysis techniques needed for advanced analysis of energy flow for safe and efficient operation of a modern marine power plant.

MARE3047 Automation and Controls 2 64.0 Hours
Practical application of automation and controls for safe operation of shipboard automated processes is the focus of this course. Students learn about automated controls and system configuration of automated control equipment for boilers, main
propulsion, and power distribution. They also learn about troubleshooting of electrical and electronic equipment, testing, and calibration and programmable logic controllers.

MARE3048 Naval Architecture  128.0 Hours
Students study concepts and calculations in naval architecture, ship construction and damage control. They also learn about and practice calculations relating to speed and power/fuel requirements of ships.

MARE3049 Motor Plant Management   128.0 Hours
Students learn safe working practices and motor plant management concepts. They also learn about efficient operation, performance assessment, detection and identification of machinery faults, inspection and adjustment of equipment as per Classification Society and statutory requirements. Management of safe working practices with respect to the Canada Shipping Act’s Marine Occupational Health and Safety and the Canada labour Code requirements are also considered.

MARE3050 Ship’s Business and Maritime Law   48.0 Hours
Management and control of compliance with legislative requirements, measures to ensure safety of life at sea and protection of the marine environment are the focus of this course. Students study United Nations Conventions on the Law of Sea, International Maritime Organization and its conventions, International Labour Organization, World Health Organization and the Canada Shipping Act and its regulations.

MATH1018 Introduction to Technical Mathematics   42.0 Hours
Students are provided a foundation in mathematics in engineering technology and related programs. Students develop skill in mathematical thinking and problem solving, and appropriately apply technology in the solution of engineering related problems using algebra, geometry, right angle trigonometry, trigonometric functions of any angle, systems of linear equations, and exponential and logarithmic functions. Additional time to strengthen and reinforce mathematical competencies be made available to those students who require it.

MATH1019 Technical Mathematics   42.0 Hours
Students continue to develop mathematical reasoning and problem solving which is reinforced through problems in an engineering context. Building on the mathematics learned in Introduction to Technical Mathematics, students explore advanced the mathematics problems needed for mechanical engineering programs. Mathematics concepts reinforced and extended are algebra, systems of linear equations, vectors and oblique triangles, graphs of trigonometric functions, complex numbers, Sequences Series and the binomial theorem.
P- MATH1018 Introduction to Technical Mathematics

MCHN2000 Machining   48.0 Hours
Students practice basic machine shop skills needed for on-board maintenance and repair. This course is conducted in the machine shop using both fixed machine and hand tools.

**MENG1018 Basic Applied Mechanics  64.0 Hours**

Students study and practice calculations related to fundamentals of applied engineering mechanics including kinematics, dynamics, statics and hydraulics. They build on their understanding of engineering science and mathematics and use skills these skills to solve mechanical problems on paper.

**WETC2000 Welding   64.0 Hours**

Students learn and practice the basics of gas and arc welding, cutting and brazing. They earn about safe working practices and the theory of proper welding to assist the ships staff performing maintenance and minor repair work required onboard ship.

**Course Description Legend**

P = Prerequisite; C = Concurrent prerequisite; CO= Corequisite

*Information contained in College documents respecting programs is correct at the time of publication. Academic content of programs and courses is revised on an ongoing basis to ensure relevance to changing educational objectives and employment market needs. The college reserves the right to add or delete programs, options, courses, timetables or campus locations subject to sufficient enrolment, and the availability of courses.*