Short Course

Applied Naval Architecture

February 6–8, 12, 14, 20, 27 and 28, 2024

CISMaRT

CISMaRT's second short course provides a series of lectures covering subjects that are normally considered and analyzed in the design of ships, as integrated and self-sufficient engineered systems. The course is aimed at engineers, policy officers and non-technical personnel who deal with aspects of ships or ship operations but do not have previous training in naval architecture. The course lectures provide high-level coverage of technical topics normally covered in a naval architecture and marine engineering degree program. Individual lecture topics are listed below.

This course will be delivered through Brightspace, a learning management system.

— Registration deadline: January 31, 2024

Ship Resistance

This module will introduce course attendees to the key elements of ship resistance. This includes how ship resistance is composed of wave-making drag and surface resistance. Procedures to predict these resistance components will be introduced and highlighted through practical examples. Methods to reduce the ship resistance will also be featured. The course is intended to provide an understanding of how Naval Architects must estimate ship resistance in order to accurately predict operational speeds and propulsion requirements. The lecture will cover common questions including:

- How does fluid flow around the hull create drag?
- What is Froude's Law and why is it important in the prediction of ship drag?
- What are some of the key factors that influence hull resistance?
- How is ship resistance predicted using model testing and/or computational fluid dynamics?
- What techniques can be used to reduce hull resistance?

Date: **February 6, 2024, 12:30–16:00 (EDT), including a half-hour break**
Lecturer: **Jon Mikkelsen, Professor, University of British Columbia, Department of Mechanical Engineering**

Marine Environment

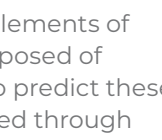
The marine environment that ships and other marine systems operate in is often harsh and demanding. Those responsible for the design and operation of such systems need, therefore, to have a good understanding of relevant environmental phenomena. These phenomena are often complex and difficult to characterize. Designers and operators from the marine community have developed various simplified methods and tools to support the maritime community for both design and operational tasks. These are outlined, as is the data required for these tasks. The sources for the data are summarized. The course will present the following topics selected to provide a broad introduction to the marine environment:

- Global climate system
- Wind
- Waves
- Currents
- Ice
- Underwater sound

Also discussed are trends such as climate change which may require modification in the treatment of relevant design variables. The lecture will also include a few simple examples and case studies relevant to aspects of the marine environment

Date: **February 7, 2024, 12:30–16:00 (EDT), including a half-hour break**
Lecturer: **Dr. Roger I. Basu, President, Roger Basu & Associates Inc.**

Ship Design Process

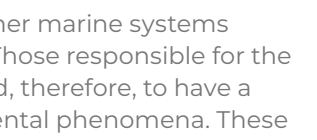


This module provides an overview of the ship design process. The course shows how all aspects of naval architecture and marine engineering are combined together to create a ship design that is best suited for it's mission requirements. The course covers:

- Phases of the ship design process – concept, preliminary, contract & detailed design
- Defining requirements for the main features of the ship – mission, function, performance and economics
- The design spiral and system-based ship design
- Preliminary ship design methods and software

Date: **February 8, 2024, 12:30–16:00 (EDT), including a half-hour break**
Lecturer: **Dan McGreer, President, McGreer Marine Consulting**

Hydrostatics and Ship Stability



This module introduces the key topics related to stability of small and large ships:

- Discussion of equilibrium of ships in still water, including a case study of a small tugboat.
- Hydrostatic curves and stability at small and large angles of heel, including a case study of a self-righting fire and rescue boat.
- Impact on vessel loading and stability, including a case study of an anchor handling / offshore tug.
- Vessel size and regulatory impacts on stability requirements.
- Dynamic stability, including a case study of an escort/ship handling tug.
- Damage stability, including a case study of a large science vessel.
- Final case study of a small fishing vessel demonstrating the impacts of various effects on vessel stability.

Date: **February 12, 2024, 12:30–16:00 (EDT), including a half-hour break**
Lecturer: **Darren Hass and Robert Gage, Naval Architects, Robert Allan Ltd.**

For more information please visit **cismart.ca/conversion-short-course** or contact **Dr. Wei Qiu** at **info@cismart.ca**.

Presented in partnership with the support of Transport Canada.

Canada

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— Registration deadline: January 31, 2024

Ship Materials and Structures

The focus of this module is on ship structures. We will explain why they are mainly built from steel and why they look as they do. The pros and cons of materials like aluminum and composites will be described. Ship structural design is tightly controlled by the structural requirements in Classification Society rules. The reasons for this as well as some of the basic principles inherent in the rules will be discussed. The question of the longitudinal strength of ships is a special focus because of the critical importance of longitudinal strength to ship safety. We will take both a first-principle and a rule-based look at this issue. Following that we will discuss the strength of plating and framing. We will wrap up with a short discussion of a variety of other topics that ship structural specialists must also consider.

Date: **February 14, 2024, 12:30–16:00 (EDT), including a half-hour break**
Lecturer: **Dr. Claude Daley, Professor, Memorial University, Department of Ocean and Naval Architectural Engineering**

Ship Electrical Systems

This course module is an introduction to electrical and control systems from a marine classification and regulatory perspective. The harsh marine environment, prescriptive statutory requirements, environmental protection implications and solitary nature of ships present themselves with inherent engineering challenges. As all sectors of the industry strive to become more environmentally conscious the marine world is adapting by driving changes of the ships of yesteryear to current challenges of decarbonization, reduction of staffing and autonomous capability by introducing complex electrotechnical designs. The course module will introduce concepts focusing on electrotechnical matters such as:

- International standards and regulations including aspects of SOLAS, IMO and IACS and flag administration such as Transport Canada
- Standard electrical ship design concepts in terms of redundancies, survivability, emergency principles
- Modern ship design with regards to electrification and energy storage

Date: **February 20, 2024, 12:30–16:00 (EDT), including a half-hour break**
Lecturer: **Matthew Partyka, Lead Specialist in Electrical and Control, Lloyds Register**

Maneuvering and Seakeeping

This module describes seakeeping and maneuvering, including underlying physics, analysis methods, and design considerations. Lessons learned are provided from a variety of sources, including numerical simulations, model tests, sea trials, and operational experience.

- Ocean waves;
- Seakeeping, including prediction of ship motions and application of motion predictions;
- Maneuvering in calm water;
- Maneuvering in waves;
- Complex scenarios, including replenishment at sea, and launch and recovery.

Date: **February 27, 2024, 12:30–16:00 (EDT), including a half-hour break**
Lecturer: **Dr. Kevin McTaggart, Leader, Simulation of Naval Platforms Group, Defence Research and Development Canada**

Ship Propulsion

This module describes some common ways energy is converted into practical propulsion devices for ships. The module starts with a review of different propulsive devices, compares their relative performance, and then explains why screw propellers have become by far and away the most common device. Propellers are usually placed at the aft end of the ship, and as a result, the flow into the propeller is affected by the ship in front. Understanding the interaction between the main engine, the hull, and the propeller, as well as the presence of cavitation in the flow are key parts of managing the noise generated by ships. The module will cover

- Types of propulsion device (screw propellers, podded propellers, water jets, vertical axis propellers and paddle wheels)
- Theory of screw propellers
- Selecting the main mechanical components of ship propulsion system (engine, drive shaft, bearings, etc.)
- Hydrodynamic interactions between the ship and the propeller
- Practical approaches for designing screw propellers
- Cavitation
- Fuel saving devices

Date: **February 28, 2024, 12:30–16:00 (EDT), including a half-hour break**
Lecturer: **Dr. David Molyneux, Associate Professor, Memorial University, Department of Ocean and Naval Architectural Engineering**

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