

Nautical Science

CAS NS 223 (3 credits)

Course Catalog Description (max. 40 words):

Learn the fundamentals of sailing ship operation, in preparation for direct application at sea. Navigation (piloting, celestial and electronic), weather, engineering systems, safety, and sail theory. Participate as an active member of the ship's crew on an offshore voyage.

Instructor(s): Sea Education Association (SEA) Nautical Science Faculty

Location: SEA campus in Woods Hole, MA, and at sea aboard SEA sailing school vessel.

Prerequisites: Admission to the SEA Semester.

Course Philosophy and Approach:

Nautical Science is a three-credit course, formed by the combination of a six-week shore component in Woods Hole and a six-week sea component aboard an SEA vessel. The objective of the shore curriculum is to introduce the topics necessary for students to join the ship as active members of the crew. Once at sea, students will work under the guidance of the vessel's professional staff to build upon the fundamentals taught ashore. Aboard ship, under a system of progressive responsibility, trainees will work in stages towards the ultimate role of Junior Watch Officer (JWO), at which point they will assume direct oversight of ship operations.

The shore component syllabus will cover all the essential disciplines of the mariner: Terrestrial and Offshore Navigation, Weather, Marine Safety, Engineering, and the Principles of Sailing Vessel Operation.

This course consists of 16 mixed lecture/practical skills sessions ashore (2 hours each), and approximately 120 hours of supervised watchstanding time at sea in the deck and engineering departments during ~30 underway days at sea.

Learning Outcomes:

1. Students will be proficient with the processes and underlying principles of analog and electronic navigation, including use of charts, compasses, GPS, Radar, and celestial instruments.
2. Students will understand weather from a mariner's perspective, including the physical foundations of meteorology, observation, forecasting, and the impact of weather on navigational decisions.
3. Students will learn the principles of sailing ship operation, including sail theory, stability, maneuvering under sail, and sail trim for optimum performance.
4. Students will become proficient operators of ship's engineering systems, including diesel engines, AC and DC electrical circuits, pumps, tankage, and refrigeration.
5. Students will develop leadership and communication skills through active experience in settings with true consequences.

6. Students will be skilled in the use of ship's safety equipment and procedures, including lifesaving, firefighting, and rescue gear. They will understand the effective development of plans and contingencies for emergency management.

Evaluation:

Exams (2)	40%
Celestial Navigation Problem Set	20%
Class Projects (2)	10%
Ship Assignments/Sea Component Evaluations	30%

Assignments:

Exams: Students complete two exams during the shore component. The first, a *Piloting Exam*, is an in-class exam to test proficiency in piloting skills. Prior to taking this exam, students complete a series of chart-based navigational problems designed to introduce the nautical chart and develop proficiency in plotting and “piloting”, or navigation using terrestrial features, lights, and buoys. These problems are ungraded, but are necessary preparation for the piloting exam. The second exam is a comprehensive *Final Exam* given at the end of the shore component. Each exam is worth 20% of the course grade.

Celestial Navigation Problem Set: Students complete an initial problem set in support of the celestial navigation unit, which provides ungraded practice problems. They then complete a graded take-home problem set designed to test proficiency in the classroom phase of celestial navigation.

Class Projects: Two projects requiring preparation and brief presentation to the class and/or the instructor. Most commonly, these will involve a set of land-based weather observations while in Woods Hole, and a group-prepared case study analysis in support of the safety unit. Due dates are determined as appropriate within the shore component portion of the course syllabus.

Ship Assignments/Sea Component Evaluations: At sea, students will be required to complete a series of small assignments which, together with evaluations from the seagoing staff, will comprise 30% of the final grade. Ship assignments will generally include practical checklists, celestial navigation tasks, engineering systems diagrams, and routine analyses of weather, route information, and ship status. A “practical skills exam” may be used to assess proficiency in critical skills, once the introductory phase of the sea component is complete.

Expectations and Requirements:

- Punctual attendance is required at every class meeting.
- Active participation in class discussion is expected.
- Late assignment submissions are not accepted.
- The policy on academic accuracy, quoted below, will be strictly followed in this class.

The papers that you submit in this course are expected to be ***your original work***. You must take care to distinguish your own ideas and knowledge from wording or substantive information that you derive from one of your sources. The term

“sources” includes not only published primary and secondary material, but also information and opinions gained directly from other people and text that you cut and paste from any site on the Internet.

The responsibility for learning the proper forms of citation lies with you.

Quotations must be placed properly within quotation marks and must be cited fully. In addition, all paraphrased material must be acknowledged completely. Whenever ideas or facts are derived from your reading and research, the sources must be indicated. (Harvard *Handbook for Students*, 305)

- Considerations for use of internet sources:

As you browse websites, assess their usefulness very critically. Who posted the information and why? Can you trust them to be correct? Authoritative? Unbiased? (It’s okay to use a biased source as long as you incorporate it knowingly and transparently into your own work.) Keep track of good sources that might be useful for subsequent assignments, and annotate in your bibliography any sites you cite. Your annotation should include the name of the author or organization originating any material that you reference. If you can’t identify the source, don’t use it!

Readings:

Adkins, Jan. The Craft of Sail: A Primer of Sailing. St. Martins Press, 1994

Chase, Carl. An Introduction to Nautical Science, Norton, 1991

Cutler, Thomas. Dutton’s Nautical Navigation, 15th ed. Naval Institute Press, 2003

LaDage, John, and Van Gemert, Lee. Stability and Trim for the Ship’s Officer. Cornell Maritime, 1979

Rappaport, Elliot. “What is Weather?” The Sea Education Association, 2007

SEA (Various) “Organization & Operations Manual for the Sea Component”

United States Coast Guard (USGS). Navigation Rules: International and Inland. Paradise Key, 2013

Course Calendar:

Topic	Readings/Assignments Due
Week 1 (4 Hours) – on shore at SEA campus in Woods Hole	
The Mariner’s Earth <ul style="list-style-type: none"> • An introduction to nautical charts • Aids to navigation • The global coordinate system 	Readings: Chase (1991): Chapters 8-9
Week 2 (6 Hours) – on shore at SEA campus in Woods Hole	
Piloting and Inshore Navigation <ul style="list-style-type: none"> • The compass • Lines of position • Fixes, ETA • Currents • Electronic navigation Piloting Exam	Readings: Chase (1991): Chapter 10 Cutler (2003): Chapters 4-5
Week 3 (6 Hours) – on shore at SEA campus in Woods Hole	
An Introduction to Celestial Navigation <ul style="list-style-type: none"> • Celestial observations • Time and the Nautical Almanac • Local Apparent Noon (LAN) 	Readings: Chase (1991): Chapters 11-13, 15
Week 4 (6 Hours) – on shore at SEA campus in Woods Hole	
Topics in Celestial Navigation <ul style="list-style-type: none"> • Plotting celestial data • The celestial triangle An Introduction to Weather <ul style="list-style-type: none"> • Temperate weather: air masses, fronts, and extratropical cyclones • Tropical weather: trades, squalls, and tropical cyclones 	Celestial Problem Set due. Readings: Rappaport (2007): “What is Weather?”
Week 5 (6 Hours) – on shore at SEA campus in Woods Hole	
An Introduction to Sailing <ul style="list-style-type: none"> • Sails and rigging • Sail Theory • Shiphandling under sail • Stability 	Readings: Adkins (1994): pp. 10-36 Chase (1991): Chapters 2-4 LaDage & Van Gemert (1979): Chapter 1

Week 6 (4 hours) – on shore at SEA campus in Woods Hole	
<p>Ships Systems</p> <p>Watchkeeping and Safety at Sea</p> <ul style="list-style-type: none"> • Rules of the road • Bridge resource management • Emergency preparedness <p>Life at Sea</p> <ul style="list-style-type: none"> • Watches and schedules • Staff roles and responsibilities <p>Final Exam</p>	<p>Readings:</p> <p>Chase (1991): Chapter 5 USCG (2013): Navigation Rules</p> <p>SEA -“Organizational and Operations Manual for the Sea Component”</p>
Weeks 7 and 8 (40 hours) – at sea	
<p>Deck Watchstanding I: Introductory Phase</p> <ul style="list-style-type: none"> • Shipboard orientation • Safety and emergency management • Departmental training: Seamanship and sailhandling; Scientific sampling; Navigation; Food service and sanitation • Initial watchstanding experiences 	<p>Ship assignments due (see description above).</p>
Weeks 9 and 10 (40 hours) – at sea	
<p>Deck Watchstanding II: Apprentice Phase</p> <ul style="list-style-type: none"> • Advanced training in practical ship evolutions • Task management and delegation • Each student shadows professional crew leaders as apprentice • Continued watchstanding experiences 	<p>Ship assignments due (see description above).</p>
Weeks 11 and 12 (40 hours) – at sea	
<p>Deck Watchstanding III: Junior Watch Officer (JWO) Phase</p> <ul style="list-style-type: none"> • Continued watchstanding experiences • Each student assumes direct oversight of ship’s operations during opportunities to serve as JWO. 	<p>Ship assignments due (see description above).</p>