

Kasetsart University
Faculty of International Maritime Studies
Program in Nautical Science

1. NAME OF CURRICULUM

Bachelor of Science Program in Nautical Science

2. NAME OF DEGREE

Bachelor of Science (Nautical Science)

B.S. (Nautical Science)

3. Curriculum Outline for Nautical Science Student

Total credit requirements	at least	149	credits
1) General Education Courses	at least	30	credits
1.1) Wellness	at least	6	credits
1.2) Entrepreneurship	at least	3	credits
1.3) Language and Communication	at least	13	credits
1.4) Thai Citizen and Global Citizen	at least	5	credits
1.5) Aesthetics	at least	3	credits
2) Nautical Science Courses	at least	113	credits
2.1) Compulsory Courses	at least	107	credits
2.2) Elective Courses	at least	6	credits
3) Free Electives	at least	6	credits
4) Training	at least	67	workdays
5) Detail of Curriculum			
1. General Education Courses	at least	30	credits
1.1 Wellness	at least	6	credits
01175131 Swimming for Health			1(0-2-1)

* Student has to obtain the other 5 credits, at least, by choosing other subjects in this category.

1.2 Entrepreneurship **at least** **3** **credits**

* Student has to choose subjects in this category to complete minimum credit requirement.

1.3	Language and Communication	at least	13	credits
	01999021 Thai Language for Communication			3(3-0-6)
	01355xxx English			9(- -)
	Information Technology/Computer at least			1(- -)

1.4	Thai Citizen and Global Citizen	at least	5	credits
	01999111 Knowledge of the Land			2(2-0-4)

* Student has to obtain the other 3 credits, at least, by choosing other subjects in this category.

1.5	Aesthetics	at least	3	credits
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* Student has to choose subjects in this category to complete minimum credit requirement.

2.	Nautical Science Courses	at least	113	credits
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2.1	Compulsory Courses	at least	104	credits
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	01417111 Calculus I			3(3-0-6)
	01420111 General Physics I			3(3-0-6)
	01420113 Laboratory in Physics I			1(0-3-2)
	03521113 Introduction to Navigation			3(3-0-6)
	03521141 Maritime Meteorology I			3(3-0-6)
	03521151 Terrestrial Navigation			3(3-0-6)
	03521152 Chartwork			3(2-3-6)
	03521153 Charts and Publications for Navigation			3(2-3-6)
	03521221 Principal Structural Member of a Ship I			2(2-0-4)
	03521222 Principal Structural Member of a Ship II			2(2-0-4)
	03521232 Shipbourne Electrical and Navigation System			3(3-0-6)
	03521233 Shipbourne Electrical and Navigation System Laboratory			1(0-3-2)
	03521243 Maritime Meteorology II			2(2-0-4)
	03521252 Celestial Navigation I			3(3-0-6)
	03521253 Maintaining a Safe Navigation Watch I			3(2-3-6)
	03521254 Celestial Navigation II			2(2-0-4)
	03521255 Maintaining a Safe Navigational Watch II			3(2-3-6)
	03521256 Electronic Navigation			2(2-0-4)
	03521272 Maritime Law for Navigation			2(2-0-4)
	03521273 Maritime Law for Environment I			2(2-0-4)

03521274	Cargo Handling and Stowage at the Operational Level I	2(2-0-4)
03521275	Cargo Handling and Stowage at the Operational Level II	3(3-0-6)
03521321	General Knowledge of Engineering Systems I	2(2-0-4)
03521322	Maintaining Sea Worthiness of Ship	3(3-0-6)
03521323	Ship Stability	3(3-0-6)
03521342	Weather Forecast and Oceanography	3(3-0-6)
03521351	Response to Emergencies	3(3-0-6)
03521353	Ship Manoeuvring I	3(3-0-6)
03521374	Maritime Law for Environment II	3(3-0-6)
03521375	Cargo Handling and Stowage at the Management Level I	3(3-0-6)
03521376	Cargo Handling and Stowage at the Management Level II	3(3-0-6)
03521421	Stability and Damage Control	3(3-0-6)
03521422	General Knowledge of Engineering Systems II	3(3-0-6)
03521423	Stability and Rolling of Ships	2(2-0-4)
03521451	Ship Manoeuvring II	3(3-0-6)
03521452	Voyage Planning	3(2-3-6)
03521453	Watchkeeping Arrangements and Procedures	3(3-0-6)
03521454	Accuracy of Resultant Position	3(3-0-6)
03521474	Safety and Medical Care Onboard	2(2-0-4)
03521477	Compass Errors	3(3-0-6)
03521478	Cargo Handling and Stowage at the Management Level III	3(3-0-6)

2.2 Elective Courses at least 6 credits

from the following courses -:

03521443	Tropical Meteorology	3(3-0-6)
03521444	Coastal Engineering	3(3-0-6)
03521471	Maritime Economics	3(3-0-6)
03521472	Port Management	3(3-0-6)
03521473	Marine Insurance	3(3-0-6)
03521475	Leaderships and Managerial Skills	3(3-0-6)

03521476	Pollution Prevention from Maritime Transportation	3(3-0-6)
03521496	Selected topics in Nautical Science	3(3-0-6)
03521497	Seminar	1
03521498	Special Problems	1-3
3.	Free Electives	at least 6 credits
4.	Training	at least 67 workdays

Student who wish for working in ocean liners after graduate.

- Basic Seamanship
- Basic Seaboard
 - Elementary first aid
 - Personal survival techniques
 - Fire prevention and fire fighting
 - Security awareness training for all seafarers
 - Personal safety and social responsibilities
- Leadership and Teamwork
- Operational Use of Electronic Chart Display and Information Systems (ECDIS)
- Medical First Aid
- Proficiency in Survival Craft and Rescue Boats (other than Fast Rescue Boats)
- Advanced Training in Fire Fighting
- On board training
- Global Maritime Distress and Safety System (GMDSS)
- Radar Navigation, Radar Plotting and use of Arpa – Radar Navigation at Operation Level
- Radar, Arpa, Bridge Teamwork and Search and Rescue–Radar Navigation at Management Level
- Ship Simulator and Bridge Teamwork
- Automatic Identification System
- Maritime English

Course Planning for Nautical science Students

First Year

Semester 1

Course Number	Title	Credits (lecture-lab-self study)
01175131	Swimming for Health	1(0-2-1)
01417111	Calculus I	3(3-0-6)
01420111	General Physics I	3(3-0-6)
01420113	Laboratory in Physics I	1(0-3-2)
01999111	Knowledge of the Land	2(2-0-4)
01999021	Thai Language for Communication	3(3-0-6)
03521113	Introduction to Navigation	3(3-0-6)
01355xxx	English	3(- -)
	Information Technology/Computer	<u>1(- -)</u>
	Totat	<u>20(- -)</u>

End of Semester 1

- Basic Seaboard Not less than 9 workdays

Semester 2

Course Number	Title	Credits (lecture-lab-self study)
03521141	Maritime Meteorology I	3(3-0-6)
03521151	Terrestrial Navigation	3(3-0-6)
03521152	Chartwork	3(2-3-6)
03521153	Charts and Publications for Navigation	3(2-3-6)
01355xxx	English	3(- -)
	Wellness	3(- -)
	Aesthetics	<u>3(- -)</u>
	Totat	<u>21(- -)</u>

Maritime English

End of Semester 2

- | | | |
|--|-----------------|----------|
| - Radar Navigation, Radar Plotting and use of Arpa – Radar Navigation at Operation Level | Not less than 9 | workdays |
| - Medical First Aid | Not less than 4 | workdays |
| - Proficiency in Survival Craft and Rescue Boats (other than Fast Rescue Boats) | Not less than 4 | workdays |
| - Advanced Training in Fire Fighting | Not less than 4 | workdays |

Second Year

Semester 1

Course Number	Title	Credits (lecture-lab-self study)
03521221	Principal Structural Member of a Ship I	2(2-0-4)
03521232	Shipbourne Electrical and Navigation System	3(3-0-6)
03521233	Shipbourne Electrical and Navigation System Laboratory	1(0-3-2)
03521252	Celestial Navigation I	3(3-0-6)
03521253	Maintaining a Safe Navigation Watch I	3(2-3-6)
03521272	Maritime Law for Navigation	2(2-0-4)
03521274	Cargo Handling and Stowage at the Operational Level I	2(2-0-4)
01355xxx	English	<u>3(- -)</u>
	Total	<u>19(- -)</u>
Maritime English		

End of Semester 1

- | | | |
|---|-----------------|----------|
| - Leadership and Teamwork | Not less than 3 | workdays |
| - Operational Use of Electronic Chart Display and Information Systems (ECDIS) | Not less than 5 | workdays |
| - Automatic Identification System | Not less than 2 | workdays |

Semester 2

Course Number	Title	Credits (lecture-lab-self study)
03521222	Principal Structural Member of a Ship II	2(2-0-4)
03521243	Maritime Meteorology II	2(2-0-4)
03521254	Celestial Navigation II	2(2-0-4)
03521255	Maintaining a Safe Navigational Watch II	3(2-3-6)
03521256	Electronic Navigation	2(2-0-4)
03521273	Maritime Law for Environment I	2(2-0-4)
03521275	Cargo Handling and Stowage at the Operational Level II	3(3-0-6)
	Entrepreneurship	<u>3(- -)</u>
	Total	<u>19(- -)</u>

Maritime English

End of Semester 2

- Global Maritime Distress and Safety System (GMDSS) Not less than 17 workdays

Third Year

Semester 1

Course Number	Title	Credits (lecture-lab-self study)
03521322	Maintaining Sea Worthiness of Ship	3(3-0-6)
03521342	Weather Forecast and Ocenography	3(3-0-6)
03521353	Ship Manoeuvring I	3(3-0-6)
03521374	Maritime Law for Environment II	3(3-0-6)
03521375	Cargo Handling and Stowage at the Management Level I	3(3-0-6)
	Wellness	2(- -)
	Free Electives	<u>3(- -)</u>
	Total	<u>20(- -)</u>

Maritime English

End of Semester 1

- Radar, Arpa, Bridge Teamwork and Search and Rescue–Radar Navigation at Management Level Not less than 5 workdays
- Ship Simulator and Bridge Teamwork Not less than 5 workdays

Semester 2

Course Number	Title	Credits (lecture-lab-self study)
03521321	General Knowledge of Engineering Systems I	2(2-0-4)
03521323	Ship Stability	3(3-0-6)
03521351	Response to Emergencies	3(3-0-6)
03521376	Cargo Handling and Stowage at the Management Level II	3(3-0-6)
	Thai Citizen and Global Citizen	3(- -)
	Elective Courses	3(- -)
	Free Electives	<u>3(- -)</u>
	Totat	<u>20(- -)</u>
Maritime English		

End of Semester 2

- On board training

Fourth Year

Semester 1

Course Number	Title	Credits (lecture-lab-self study)
03521422	General Knowledge of Engineering Systems II	2(2-0-4)
03521423	Stability and Rolling of Ships	2(2-0-4)
03521451	Ship Manoeuvring II	3(3-0-6)
03521452	Voyage Planning	3(2-3-4)
03521454	Accuracy of Resultant Position	3(3-0-6)
03521474	Safety and Medical Care Onboard	2(2-0-4)
03521478	Cargo Handling and Stowage at the Management Level III	3(3-0-6)
	Elective Courses	<u>3(- -)</u>
	Total	<u>21(- -)</u>
Maritime English		

Semester 2

Course Number	Title	Credits (lecture-lab-self study)
03521421	Stability and Damage Control	3(3-0-6)
03521453	Watchkeeping Arrangements and Procedures	3(3-0-6)
03521477	Compass Errors	<u>3(3-0-6)</u>
	Total	<u>9(9-0-18)</u>
Maritime English		

COURSE DESCRIPTIONS

03521111	Basic Calculation for Navigator	3(3-0-6)
	Plane trigonometry. Solid geometry. Fundamental spherical trigonometry. Terrestrial sphere. Geographic Coordinates for navigation. Vector space. System of linear equations and matrices. Taylor series. Partial derivatives for navigation.	
03521113	Introduction to Navigation	3(3-0-6)
	Charts. Navigation chart. Electronic chart. International Association of Lighthouse Authorities Buoyage systems (IALA). Keeping a log.	
03521114	Mathematics for Navigator	3(3-0-6)
	Prerequisite : 03521111	
	Definition. Spherical property. Spherical triangle. Terrestrial sphere. Napier's rule. Problem solving in spherical triangle. Application of spherical trigonometry in navigation.	
03521141	Maritime Meteorology I	3(3-0-6)
	Atmosphere. Shipborne meteorological instruments. Atmospheric pressure. Wind. Cloud and precipitation. Visibility. Wind and pressure system over the ocean.	
03521151	Terrestrial Navigation	3(3-0-6)
	Position lines and positions. Plots the position on the chart. Dead reckoning position (DR), estimated position (EP) and fixed position. Plots position line straight line, circle, and hyperbola. Sailing. Solves problems of plane sailing.	
03521152	Chartwork	3(2-3-6)
	Definitions of set, rate, drift and leeway due to current and wind. Lays off true course between two positions. Finds the distance between two positions. Ship's speed and Effective speed. Running fix.	
03521153	Charts and Publications for Navigation	3(2-3-6)
	Information from charts. Lists of lights and publications for navigation. Tide and current.	

03521221	Principal Structural Member of a Ship I Ship dimensions and form. Ship stresses. Hull structure.	2(2-0-4)
03521222	Principal Structural Member of a Ship II Bow and stern regions. Fittings. Rudders and propellers. Load lines and draught marks.	2(2-0-4)
03521232	Shipborne Electrical and Navigation System Basic electrical system on bridge. Direct current. Alternate current. Electromagnetic wave and electronics using in onboard navigation system consists of: echo-sounders, magnetic compass and Gyro compass. Magnetism of the earth and ship deviation. Compass correction. Errors of compass and azimuth. Fluxgate compass, and steering system.	3(3-0-6)
03521233	Shipborne Electrical and Navigation System Laboratory Corequisite : 03521232 Circuit and measurement of direct current. Alternate current. Electromagnetic wave, and electronics circuits. Echo-sounders. Magnetic compass and Gyro compass operation. Magnetism of the earth and ship deviation measurement. Compass correction. Errors of compass and azimuth. Fluxgate compass and steering system familiarization.	1(0-3-2)
03521242	Weather Forecast Prerequisite: 03521241 Synoptic and prognostic charts. Weather forecasting. Tropical revolving storms.	2(2-0-4)
03521243	Maritime Meteorology II Structure of depressions. Anticyclones and other pressure systems. Weather services for shipping. Recording and reporting weather observations. Weather charts.	3(3-0-6)

03521251	<p>Terrestrial Navigation II</p> <p>Prerequisite : 03521151</p> <p>Definitions of departure, true course, set, rate, drift and leeway due to wind and rhumb line. Calculation of the difference of longitude. Use of the plane sailing formulae. Layout of transverse table. Problems of plane sailings. Problems of DR and fixed positions.</p>	3(3-0-6)
03521252	<p>Celestial Navigation I</p> <p>Solar system. Celestial sphere and equinoctial system of Co-Ordinates. Hour angle. The astronomical triangle on the celestial sphere. Daily motion and horizontal system of co-ordinates. Sextant and altitude corrections. Amplitude. Time and equation of time. Nautical Almanac. Identification of celestial bodies.</p>	3(3-0-6)
03521253	<p>Maintaining a Safe Navigational Watch I</p> <p>Content, application and intent of International regulations for preventing collisions at sea 1972, as amended.</p>	3(2-3-6)
03521254	<p>Celestial Navigation II</p> <p>Prerequisite : 03521252</p> <p>Latitude by meridian altitude. Pole star observations. Position fixing.</p>	2(2-0-4)
03521255	<p>Maintaining a Safe Navigational Watch II</p> <p>Prerequisite : 03521253</p> <p>Review content, application and intent of International regulations for preventing collisions at sea, 1972, as amended. Principles to be observed in keeping a navigational watch. Keeping a watch in port. Bridge resource management. Weather routing. Use of routing in accordance with general provisions on shiprouting. Speed measurement. Knowledge of navigational techniques used for safe navigation in restricted visibility. Use of reporting in accordance with the general principles for ship reporting systems and with VTS procedures</p>	3(2-3-6)

03521256	Electronic Navigation	2(2-0-4)
	Basic principles of terrestrial navigation systems. Loran-C system. eLoran. Global navigation satellite systems. GPS. Augmented satellite systems. GLONASS. GALILEO.	
03521272	Maritime Law for Navigation	2(2-0-4)
	Introduction to maritime law. Law of the sea. International convention on load lines, 1966. SOLAS-1974 as amended. SOLAS - subdivision and stability. SOLAS - fire protection, detection and extinction. SOLAS - LSA and arrangements (LSA code). SOLAS - radio communications. SOLAS - carriage of grain. SOLAS - carriage of dangerous goods. ISM code. STCW convention, 1978, as amended. STP ships agreement, 1971. SPACE STP 1973. PAL 1974. Tonnage 1969. BWM 2004. AFS convention, 2001. Guidelines on the enhanced program of inspections during surveys of bulk carriers and oil tankers. Code of safe working practices for merchant seamen. ISPS code.	
03521273	Maritime Law for Environment I	2(2-0-4)
	Prerequisite : 03521272	
	MARPOL 73/78. Convention and legislations adopted by various countries. Control of discharge of oil. Oil record book (part I - machinery space operations) and part II - cargo/ballast operations). Shipboard oil pollution emergency plan (SOPEP) including. Shipboard marine pollution emergency plans (SMPEP) for oil and/or noxious liquid substances and vessel response plan (VRP). Operating procedures of anti-pollution equipment, sewage plant, incinerator, comminutor, ballast water treatment plant. Volatile organic compound (VOC) management plan, garbage management system, anti-fouling systems, ballast proactive measures to protect the marine environment.	
03521274	Cargo Handling and Stowage at the Operational Level I	2(2-0-4)
	Sea worthiness and stability of the ship. Securing cargoes. Deck cargo. Container cargo. Bulk cargo and Bulk grain cargo.	

03521275	Cargo Handling and Stowage at the Operational Level II Safe handling, stowage and securing of cargoes. Inspect and report defects and damage to cargoes spaces, hatch covers and ballast tanks.	3(3-0-6)
03521321	General Knowledge of Engineering Systems I Principle of marine diesel, steam and gas turbine engine operation. Describe the arrangement and operation of propeller shaft and propeller. Describe bridge control operation for engines, propeller, steam boiler, maintenance and safety. Using correct engineering terms when explaining the operation of the machinery and relating equipment. Calculating the fuel consumption for a voyage and defining the Admiralty coefficient and fuel coefficient.	2(2-0-4)
03521322	Maintaining Sea Worthiness of Ship Displacement. Buoyancy. Fresh water allowance. Static stability. Initial stability. Angle of loll. Curves of static stability. Movement of center of gravity. List and its correction. Effect of slack tanks. Trim and draught calculations using trim tables. Actions to be taken in the event of partial loss of intact buoyancy. Stress tables and stress calculating equipment (loadicator).	3(3-0-6)
03521323	Ship Stability Shipbuilding materials, welding, bulkheads, watertight and weathertight doors, corrosion and its prevention, surveys and dry-docking, Calculation of areas and volumes. Effects of density. Stability at moderate and large angles of heel.	3(3-0-6)
03521341	Oceanography Ocean. Physicochemical properties of ocean. Global ocean circulation and stratification. Wind and wave generation in the ocean. Main types of floating ice, their origins and movements. Guiding principles relating to the safety of navigation in the vicinity of ice. Conditions leading to ice accretion on ship's superstructures, dangers and remedies available. Surface water circulation of the ocean and principal adjoining seas. Principle of voyage planning with respect to weather conditions and wave height. Formation of	2(2-0-4)

sea waves and swell waves. Ability to calculate tidal conditions. Nautical publications on tides and currents and information which can be obtained via internet and email.

03521342 Weather Forecast and Oceanography 3(3-0-6)

Synoptic and prognostic charts. Weather forecasting. Tropical revolving storms. Floating ice. Ocean current system. Significant wave height. Wave forecasting. Formation of sea waves and swell waves. Calculation of tidal conditions. Nautical publications on tides and currents.

03521351 Response to Emergencies 3(3-0-6)

Contingency plans for response to emergencies. Precautions for protection and safety of passengers in emergency situations. Precautions when beaching a vessel. Actions following stranding/grounding. Actions following a collision. Initial damage assessment and control. Means of limiting damage and salving ship following fire or explosion. Procedures for abandoning ship. Use of auxiliary steering gear and rigging jury steering arrangements. Arrangements for towing and being towed. Rescue of persons from a vessel in distress. Actions for emergencies in port. Measures for assisting a vessel in distress. IAMSAR Manual. Signaling by Morse code. International Code of Signals. Precautions when beaching a ship. Action to be taken if grounding is imminent and after grounding. Refloating a grounded ship with and without assistance. Action to be taken if collision is imminent and following a collision or impairment of the watertight integrity of the hull by any cause. Assessment of damage control. Emergency steering. Emergency towing arrangements and towing procedure.

03521353 Ship Maneuvering I 3(3-0-6)

Turning circles and stopping distances. Effect of wind and current on ship handling. Manoeuvring for rescue of person overboard. Squat, shallow water and similar effects. Proper procedures for anchoring and mooring. Approaching pilot stations and embarking or disembarking pilots, with due regard to weather, tide, head reach and stopping distances. Handling ship in rivers, estuaries and restricted waters, having regard to the effects of current,

wind and restricted water on helm response. Application of constant rate of turn techniques. Manoeuvring in shallow water including the reduction in under-keel clearance caused by squat, rolling and pitching. Interaction between passing ships and between own ship and nearby banks (canal effect). Berthing and unberthing under various conditions of wind, tide and current with and without tugs.

03521374 Maritime Law for Environment II 3(3-0-6)
Prerequisite : 03521273

Certificates and other documents required to be carried on board ships by international conventions. Responsibilities under the relevant requirements of the international convention on load lines. Responsibilities under the relevant requirements of the international convention for the safety of life at sea. Responsibilities under the international convention for the prevention of pollution from ships. Maritime declarations of health and the requirements of the international health regulations. Responsibilities under other international maritime law embodied in international agreements and conventions that impact on the role of management level deck officers. Responsibilities under international instruments affecting the safety of the ship, passengers, crew and cargo. Methods and aids to prevent pollution of the marine environment by ships. National legislation for implementing international agreements and conventions.

03521375 Cargo Handling and Stowage at the Management Level I 3(3-0-6)
Prerequisite : 03521275

Application of international regulations, code and standards concerning the safe handling, stowage, securing and transport of cargoes. Effect on trim and stability of cargoes and cargo operations. Stability and trim diagrams and stress-calculating equipment.

03521376 Cargo Handling and Stowage at the Management Level II 3(3-0-6)

Stowage and securing of cargoes on-board ship. Procedures for receiving and delivering cargo. Cargo handling gear and lashing equipment. General

knowledge of tankers and tanker operation. Knowledge of the operational and design. Limitations of bulk carriers. Loading, care and unloading of bulk cargoes.

03521377 Maritime Meteorology II 3(3-0-6)

Theories of situation and risk assessment. Discusses formal approaches to risk assessment. Identifies typical risks that management level officers may have to assess. Demonstrates the ability to effectively assess risk in the planning and conduct of simulated or real shipboard activities.

03521421 Stability and Damage Control 3(3-0-6)

Dry-docking and grounding. Shear force, bending moments and torsional stress. Effect of flooding on transverse stability and trim. Calculation of vessel condition after flooding. Effect of flooding on trim. Theories affecting trim and stability. Responsibilities under the relevant requirements of the international conventions and codes.

03521422 General knowledge of engineering systems II 2(2-0-4)

Ships' auxiliary machinery. Distillation and fresh-water systems. Pump system. Steering gear system. Principle of DC, AC generator and electric distribution system. Refrigeration, air-conditioning and ventilation system. Ships' stabilizers. Sewage treatment plants. Oil filter and separators. Waste incinerators. Deck machinery. Hydraulic system. Marine engineering watch arrangements.

03521423 Stability and Rolling of Ships 2(2-0-4)

Simplified stability data. Trim and list. Dynamical stability. Approximate GM by means of rolling period tests. Intact stability code. Intact stability requirements for the carriage of grain. Rolling of ships.

03521443 Tropical Meteorology 3(3-0-6)

Wind, controlling factor weather change, distribution of moisture and precipitation, tropical transport, tropical waves, tropical cyclone, observations analysis and prediction of tropical weather, satellite and radar information interpretation, tropical climate and variability.

03521444	Coastal Engineering	3(3-0-6)
	<p>Coastal phenomena. Wave theory. Wave in the ocean. Wave change when approaching shallow water. Destruction and formation of coastal area. Offshore sand dune formation. Wave interaction with coastal structure. Design of coastal structure.</p>	
03521451	Ship Maneuvering II	3(3-0-6)
	<p>Prerequisite : 03521353</p> <p>Ship and tug interaction. Use of propulsion and manoeuvring systems including different types of rudder. Types of anchor; choice of anchorage; anchoring with one or two anchors in limited anchorages and factors involved in determining the length of anchor cable to be used. Procedures for anchoring in deep water and in shallow water. Dragging anchor; clearing fouled anchors. Dry-docking, both with and without damage. Management and handling ships in heavy weather including assisting a ship or aircraft in distress; towing operations; means of keeping an unmanageable ship out of a sea trough, lessening lee drift and use of oil. Precautions in manoeuvring to launch rescue boats and survival craft in bad weather. Methods of taking on board survivors from rescue boats and survival craft. Ability to determine the manoeuvring and propulsion characteristics of common types of ships, with special reference to stopping distances and turning circles at various draughts and speeds. Importance of navigating at reduced speed to avoid damage caused due to own ship's bow and stern waves. Practical measures to be taken when navigating in or near ice or in conditions of ice accumulation on board. Use of and manoeuvring in and near traffic separation schemes and in vessel traffic service (VTS) areas.</p>	
03521452	Voyage Planning	3(2-3-6)
	<p>Voyage planning for all conditions by acceptable methods of plotting ocean tracks. Navigation and monitoring of the voyage. Logbooks and voyage records. Routing. Ship reporting systems.</p>	

03521453	<p>Watchkeeping Arrangements and Procedures</p> <p>Knowledge of content, application and intent of the international regulations for preventing collisions at sea, 1972, as amended. Knowledge of the content, application and intent of the principles to be observed in keeping a navigational watch at a management level. Voyage data recorders (VDR) and bridge navigational watchkeeping alarm systems (BNWAS).</p>	3(3-0-6)
03521454	<p>Accuracy of Resultant Position</p> <p>Determine position and the accuracy of resultant position. Celestial navigation. Terrestrial observations, including the ability to use appropriate charts, notices to mariners and other publications to assess the accuracy of the resulting fix. Modern electronic navigational aids with specific knowledge of their operating principles, limitations, sources of error, detection of misrepresentation of information and methods of correction to obtain accurate position fixing.</p>	3(3-0-6)
03521471	<p>Maritime Economics</p> <p>Fundamental of economic. Relationship between maritime industry and economic. Demand and supply forecasting. Shipping fee, cost and tax.</p>	3(3-0-6)
03521472	<p>Port Management</p> <p>Business management and marketing in port industry. Maritime operation in port with environment, health and safety consideration. Port security and emergency management.</p>	3(3-0-6)
03521473	<p>Marine Insurance</p> <p>History and development of marine insurance, general average, terms and conditions.</p>	3(3-0-6)
03521474	<p>Safety and Medical Care Onboard</p> <p>Life-saving appliance regulations. Medical Care regulation. Actions to be taken to protect and safeguard all persons on board in emergencies. Actions to limit damage and save the ship following a fire, explosion, collision or grounding. Preparation of contingency plans for response to emergencies. Ship</p>	2(2-0-4)

construction including damage control. Organization and management of the provision of medical care on board. Medical publications.

- 03521475 Leaderships and Managerial Skills 3(3-0-6)
- Shipboard personnel management. Training onboard ships. Related international maritime conventions, recommendations and national legislation. Task and workload management. Application of effective resource management at a management level. Situation and risk assessment. Identify and generate options. Selecting course of action. Evaluation of outcome effectiveness.
- 03521476 Pollution Prevention from Maritime Transportation 3(3-0-6)
- Marine ecosystem. Marine water quality. Marine pollution. Effect of bilge water and ballast water on marine ecosystem and marine water quality. Marine pollution from ship-generated waste according to MARPOL 73/78 ; Marine pollution prevention and technologies from maritime transport. Case study of pollution prevention from maritime transportation.
- 03521477 Compass Errors 3(3-0-6)
- Parts of the magnetic compass and their function. Errors of the magnetic compass and their correction. Principles of gyrocompasses. Gyrocompass errors and corrections. Systems under the control of the master gyro. Operation and care of the main types of gyrocompass.
- 03521478 Cargo Handling and Stowage at the Management Level III 3(3-0-6)
- Loading and unloading. Safe cargo handling. Effective communications and improving working relationships. Limitations on strength of the vital constructional parts of a standard bulk carrier. Interpretation of bending moments and shear forces. Methods to avoid the detrimental effects on bulk carriers of corrosion, fatigue and inadequate cargo handling. Carriage of dangerous goods.

03521496	Selected topics in Nautical Science Selected topics in navigation at the bachelor's level, topics are subject to change each semester.	3(3-0-6)
03521497	Seminar Presentation and discussion of interesting topic in nautical science at the bachelor's degree level.	1
03521498	Special Problems Study and research in nautical science at the bachelor's degree level and compile into a report.	1-3

Required fundamental course descriptions

01417111	Calculus I Limits and continuity, derivatives and applications, differentials and applications, integration and applications.	3(3-0-6)
01420111	General Physics I Mechanics. Harmonic motion. Waves. Fluid mechanics. Thermodynamics.	3(3-0-6)
01420113	Laboratory in Physics I Prerequisite : 01420111 Corequisite Laboratory for General Physics I or Basic Physics I.	1(0-3-2)