

## COURSE PACKAGE

### Part A: Course Specifications

<b>Course Code</b>	:	NAV 1						
<b>Course Descriptive Title</b>	:	Terrestrial and Coastal Navigation 1						
<b>Prerequisite</b>	:	None			<b>Corequisite</b>	:	None	
<b>Year Level</b>	:	First Year			<b>Semester Offered</b>	:	First Semester	
<b>Course Credits</b>	:	4 units	<b>Theoretical Contact Hours Per Week</b>	:	3 hours	<b>Demonstration/Practical Work Contact Hours Per Week</b>	:	3 hours
<b>Course Description</b>	:	<p><b>Terrestrial and Coastal Navigation 1</b> is an introductory course in navigation. The course introduces the practical application of Geodesy in navigation and includes topics on nautical charts and publications, tides, and magnetic and gyro compasses. The students of this course are also expected to undergo practical activities and demonstrations as well as problem-based learning.</p>						
<b>STCW Reference</b>	:	<b>STCW Table</b>	<b>Function</b>	<b>Competence</b>	<b>Knowledge, Understanding and Proficiency</b>			
		A-II/1	F1. Navigation at the operational level	C1. Plan and conduct passage a and determine position	<p><i>Terrestrial and coastal navigation</i></p> <p><i>KUP 3. Thorough knowledge of and ability to use nautical charts, and publications, such as sailing directions, tide tables, notices to mariners, radio navigational warnings and ships' routeing information</i></p> <p><i>Compass – magnetic and gyro</i></p> <p><i>KUP 6. Knowledge of the principles of magnetic and gyro-compasses</i></p> <p><i>KUP 7. Ability to determine errors of the magnetic and gyro-compasses, using terrestrial means, and to allow for such</i></p>			



				errors
<b>Course Outcomes</b>	:	PO-A.1	<b>CO1.</b> Discuss the importance of navigation and learn best practices to keep oneself abreast with the present trends in maritime industry in relation to voyage planning.	
		PO-C.6	<b>CO2.</b> Outline the requirements for the carriage of nautical charts and publications from relevant IMO conventions and codes	
		PO-B.1 PO-B.3 PO-D.1	<b>CO3.</b> Obtain information for topographical, hydrographical and navigational aids and services from the nautical charts and publications for voyage planning <b>CO4.</b> Apply and record corrections to nautical charts and publications from the Notices to Mariners <b>CO5.</b> Explain the principles of terrestrial magnetism and gyroscopic principles in relation to direction finding <b>CO6.</b> Determine the true course/bearing and the magnetic and gyro errors by terrestrial observation	
<b>Course Intake Limitations</b>	:	The number of students that can be accommodated shall not exceed 40 for lecture and 20 for laboratory.		
<b>Faculty Requirement</b>	:	<p><b>Instructor</b> The faculty that will be assigned to handle the course must possess the following qualifications:</p> <ul style="list-style-type: none"> <li>• graduate of Bachelor of Science in Marine Transportation;</li> <li>• with at least 12 months of seagoing experience as Officer-in-charge of a Navigational Watch on seagoing ships of 500 GRT or more;</li> <li>• completed Training Course for Instructors (IMO Model Course 6.09);</li> <li>• completed Training Course on Assessment, Examination and Certification of Seafarers (IMO Model Course 3.12); and</li> <li>• preferably with teaching experience.</li> </ul> <p><b>Assessor</b> The assigned assessor to conduct the assessment for this course shall have the same qualification for the instructor as outlined above.</p>		
<b>Teaching Facilities and Equipment</b>	:	<p><b>CLASSROOM</b> The standard classroom size shall be a minimum of 48 square meters, no side shall be less than 6 meters for a class of 40 students. Classroom must be well-lighted and well-ventilated. It should contain the following:</p> <ul style="list-style-type: none"> <li>• Tables and chairs or armed chairs</li> <li>• Whiteboards or chalkboards</li> <li>• Multimedia equipment</li> </ul> <p><b>CHARTROOM</b> The chartroom shall be capable of holding a proportionate number of students under the following conditions:</p>		

	<ul style="list-style-type: none"> <li>• Chart table dimensions: at least L = 1.0 m, W = 0.7 m</li> <li>• Chart table ratio: 1 table is to 2 students</li> <li>• Each chart table shall have the following:             <ul style="list-style-type: none"> <li>○ Harbour chart, coastal chart, general chart and sailing chart</li> <li>○ Parallel rulers, navigational triangles, compass dividers</li> <li>○ Pencil and eraser</li> </ul> </li> </ul> <p><b>EQUIPMENT FOR DEMONSTRATION/PRACTICAL WORK</b> May be integrated in the Ship Bridge Simulator or standalone:</p> <ul style="list-style-type: none"> <li>• Pelorus</li> <li>• Magnetic Compass</li> <li>• Gyro Compass</li> </ul> <p><i>Note:</i></p> <ol style="list-style-type: none"> <li>1. The MHEIs may use additional teaching facilities and equipment as deemed necessary to meet the learning outcomes of this course.</li> <li>2. If the ship bridge simulator is used, IMO Model Course 6.10 is a required qualification for the instructor and assessor of this course.</li> </ol>
<p><b>Teaching Aids</b></p>	<p>:</p> <p><b>A1</b> PowerPoint Presentation (PPT)  <b>A2</b> Handouts  <b>A3</b> Notice to Mariners  <b>A4</b> US Chart No. 1 or BA Chart 5011 (INT 1)  <b>A5</b> Catalogue of Charts and Publications (NP 131) or the digital counterpart (e.g. Admiralty Digital Catalogue)  <b>A6</b> Nautical Publications  <b>A7</b> Charts of various scales  <b>A8</b> Plotting instruments  <b>A9</b> Instruments for nautical chart and publications corrections  <b>A10</b> Calculator  <b>A11</b> Globe (or related diagrams)  <b>A12</b> Electronic Navigational Chart (ENC) Viewer</p> <p><i>Note: The MHEIs may use additional teaching aids as deemed necessary to meet the learning outcomes of this course.</i></p>
<p><b>References / Bibliographies</b></p>	<p>:</p> <p><b>References:</b></p> <p><b>R1</b> International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended  <b>R2</b> Officer in Charge of a Navigational Watch (IMO Model Course 7.03)  <b>R3</b> International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended  <b>R4</b> IMO Resolution A.424(XI) – Performance standards for gyro compasses  <b>R5</b> IMO Resolution A.382(X) – Magnetic compass carriage and performance standards</p>



	<p><b>Textbook:</b></p> <p><b>T1</b> National Geospatial-Intelligence Agency, <i>American Practical Navigator</i> (H.O Pub No. 9) 2017 Edition (Originally by Nathaniel Bowditch)</p> <p><b>Websites:</b></p> <p><b>W1</b> NOAA Interactive Chart Locator, URL: <a href="https://charts.noaa.gov/InteractiveCatalog/nrnc.shtml">https://charts.noaa.gov/InteractiveCatalog/nrnc.shtml</a></p> <p><b>W2</b> Easy Tide, URL: <a href="http://www.ukho.gov.uk/easytide/EasyTide/SelectPort.aspx">http://www.ukho.gov.uk/easytide/EasyTide/SelectPort.aspx</a></p> <p><b>W3</b> [NOAA] Tides and Currents, URL: <a href="https://tidesandcurrents.noaa.gov/">https://tidesandcurrents.noaa.gov/</a></p> <p><b>W4</b> Simplified Harmonic Method of Tidal Prediction, URL: <a href="https://candidaries.wordpress.com/2020/07/04/simplified-harmonic-method-of-tidal-prediction/">https://candidaries.wordpress.com/2020/07/04/simplified-harmonic-method-of-tidal-prediction/</a></p> <p><b>W5</b> Admiralty Digital Catalogue. URL: <a href="https://www.admiralty.co.uk/digital-services/catalogues/admiralty-digital-catalogue">https://www.admiralty.co.uk/digital-services/catalogues/admiralty-digital-catalogue</a></p> <p><b>W6</b> The World Magnetic Model. URL: <a href="https://www.ngdc.noaa.gov/geomag/WMM/">https://www.ngdc.noaa.gov/geomag/WMM/</a></p> <p><b>W7</b> British Geological Survey: The Earth's Magnetic Field: An Overview. URL: <a href="https://geomag.bgs.ac.uk/education/earthmag.html">https://geomag.bgs.ac.uk/education/earthmag.html</a></p> <p><b>W8</b> The Gyro-Compass. URL: <a href="http://ed-thelen.org/SperryManual-05.pdf">http://ed-thelen.org/SperryManual-05.pdf</a></p> <p><b>Video:</b></p> <p><b>V1</b> AdmiraltyTV. (2019, August 28). <i>How to update ADMIRALTY Standard Nautical Charts (SNCs)</i>. Retrieved from <a href="https://www.youtube.com/playlist?list=PLIyHcA-twBuNFDcas706D6vEsmXCTPKtU">https://www.youtube.com/playlist?list=PLIyHcA-twBuNFDcas706D6vEsmXCTPKtU</a></p> <p><i>Note: The MHEIs may use additional references/bibliographies as deemed necessary to meet the learning outcomes of this course.</i></p>
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## Part B: Course Outline and Timetable

Term	Week	Topic	Time Allotment (in hours)	
			Theoretical	Demonstration/ Practical Work
<p><i>Note:</i></p> <p><i>MHEIs shall determine the number of periods or terms the semester is divided based on their school calendar of activities such as Prelim, Midterm, and Final.</i></p>	1	<b>1. Introduction to Navigation</b> 1.1 Types of Navigation 1.2 Phases of Navigation 1.3 Chartroom – Plotting instruments	3	3
	2 – 3	<b>2. Chart Projections</b> 2.1 Great circles, small circles – Parts and measurements 2.2 Geoid and ellipsoid 2.3 Chart projections 2.4 Horizontal and vertical datums	6	6
	4	<b>3. Charts</b> 3.1 Requirements for charts in navigation 3.2 Paper charts and electronic navigational charts 3.3 Chart scale 3.4 Chart classification by scale	3	3
	5 – 7	<b>4. Information from Charts, Lists of Lights and Other Publications</b> 4.1 Chart No. 1 4.2 General features 4.3 Topography 4.4 Hydrography 4.5 Navigation Aids and Services 4.6 Catalogue of charts and nautical publications (NP 131) 4.7 Different nautical publications	9	9
	8 – 9	<b>5. Tides</b> 5.1 Tidal Theories 5.2 Types of Tides 5.3 Tidal Prediction by Linear Interpolation 5.4 Tidal Prediction by Harmonic Prediction	6	6



*Annex D3  
(NAV 1 – Terrestrial and Coastal Navigation 1)*

Term	Week	Topic	Time Allotment (in hours)	
			Theoretical	Demonstration/ Practical Work
	10 – 11	<b>6. Corrections to Nautical Charts and Publications</b> 6.1 Notices to Mariners 6.2 Corrections to Nautical Publications Corrections to Standard Nautical Charts	6	6
	12 – 17	<b>7. Magnetic and Gyro Compasses</b> 7.1 Principles of Terrestrial Magnetism 7.2 Magnetic Compass 7.3 Gyro Compass 7.4 Fluxgate Compass 7.5 Boxing the compass 7.6 Compass error 7.7 “Correcting” and “un-correcting” the compass	18	18
<b>Sub-total (Contact Hours)</b>			<b>51</b>	<b>51</b>
<b>Total Contact Hours</b>			<b>102</b>	
<b>Examination and Assessment</b>				

**Note:**

1. *The MHEIs are to develop their respective timetable according to their resources and needs of students but should meet with the minimum time allocation for the contact hours.*
2. *The MHEIs shall determine the time allotment for the conduct of summative assessments*



## Part C: Course Syllabus

COs	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
CO1	<p><b>1. Introduction to Navigation</b>            1.1. Outline the requirements of the course            1.2. Describe the development of navigational techniques, practices and equipment across time            1.3. Explain the importance of navigation in relation to the profession</p> <p><b>Types of Navigation and Phases of Navigation</b>            1.4. Explain the different types of navigation with respect to the phase of the voyage</p> <p><b>Chartroom – Plotting instruments</b>            1.5. Identify the different plotting instruments and their uses</p>	R1, T1	A1, A2, A8
CO3	<p><b>2. Charts Projections</b>  <b>Great circles, small circles – Parts and measurements</b>            2.1. Identify the different parts of the great circle and its measurements            2.2. Solve for the difference of latitude and the difference of longitude</p> <p><b>Geoid and ellipsoid and Chart projections</b>            2.3. Explain basic geodesic concepts in relation to chart projection and construction and the establishment of chart datum            2.4. Compare and contrast the different types of chart projections in relation to their practical uses and features</p> <p><b>Horizontal and vertical datums</b>            2.5. Explain the difference in coordinates between datums referred to as 'datum shift'            2.6. Evaluate the effect to the safety to navigation of using a chart given its horizontal and vertical datum</p>	T1	A1, A2, A7
CO2 CO3	<p><b>3. Charts</b>  <b>Requirements for charts in navigation</b>            3.1. Explain the purpose of nautical chart in navigation            3.2. Determine the requirements for the carriage of charts used in navigation</p> <p><b>Paper charts and electronic navigational charts</b>            3.3. Explain the development on the use of electronic navigational chart            3.4. Compare and contrast paper charts and electronic navigational charts with regards to their use and limitations</p> <p><b>Chart scale and Chart classification by scale</b></p>	R1, R3, T1, W1 R1, R3, T1, W1	A1, A2, A7, A11 A1, A2, A7, A12





COs	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
	<p>3.5. Determine the natural scale of the chart and its classification given the said natural scale</p> <p>3.6. Determine the length on the chart of a given distance based on a given scale and vice versa</p>		
CO3	<p><b>4. Information from Charts, Lists of Lights and Other Publications</b> <b>Chart No. 1 and General features</b></p> <p>4.1. Extract information from the chart regarding its publication</p> <p><b>Topography and Hydrography</b></p> <p>4.2. Interpret topographical and hydrographical information symbols and abbreviations obtained from the Mercator chart</p> <p><b>Navigation Aids and Services</b></p> <p>4.3. Determine the characteristics of buoys and beacons in the day and night based on the charted information and or the information obtained from the List of Lights</p> <p>4.4. Compare and contrast regions A and B of the IALA Buoyage System with regards to the arrangement of buoys and beacons along the direction of traffic</p> <p><b>Catalogue of charts and nautical publications (NP 131)</b></p> <p>4.5. Use catalogue of charts and nautical publications to obtain the required chart and nautical publications for the intended voyage</p> <p><b>Different nautical publications</b></p> <p>4.6. Use the nautical charts and publications in order to obtain the required information for the intended voyage</p>	R1, R3, T1, W1	A1, A2, A4, A5, A6, A7
CO3	<p><b>5. Tides</b> <b>Tidal Theories and Types of Tides</b></p> <p>5.1. Explain the different factors which affects tidal conditions</p> <p><b>Tidal Prediction by Linear Interpolation and Tidal Prediction by Harmonic Prediction</b></p> <p>5.2. Determine the tidal condition by linear interpolation and harmonic prediction</p> <p>5.3. Use tidal prediction software in order to obtain relevant tidal information</p> <p>5.4. Calculate the under-keel and vertical clearance of the ship for the safe passage</p>	T1, W2, W3, W4	A1, A2, A4, A5, A7, A10
CO4	<p><b>6. Corrections to Nautical Charts and Publications</b> <b>Notices to Mariners</b></p> <p>6.1. Explain the requirements and importance of correcting nautical charts and publications for navigational safety</p> <p><b>Corrections to Nautical Publications and Corrections to Standard Nautical Charts</b></p> <p>6.2. Identify the correct equipment and tools and their uses for the correction of nautical charts and publications</p>	R1, R3, T1, V1	A1, A2, A4, A5, A6, A7, A9





COs	Topics Learning Outcomes	References/ Bibliographies	Teaching Aids
	6.3. Apply and record corrections to nautical charts and publications from the Notices to Mariners (NTMs)		
CO5 CO6	<p><b>7. Magnetic and Gyro Compasses</b> <i>Principles of Terrestrial Magnetism</i></p> <p>7.1. Describe the interactions around a magnetic field and how the compass works within the Earth's magnetic field 7.2. Compare and contrast permanent magnetism from induced magnetism and its effect to the ship's magnetic compass</p> <p><b>Magnetic Compass</b> 7.3. Identify the parts of the magnetic compass and their functions 7.4. Describe the construction of the ship's magnetic compass 7.5. Outline the requirements for the magnetic compass in relation to compass error</p> <p><b>Gyro Compass</b> 7.6. Explain how gyroscopic properties are used to determine the direction of the "True North" 7.7. Identify the parts of the gyro compass and their functions 7.8. Describe how heading input is supplied by the gyro compass to other navigational equipment such as Radar</p> <p><b>Fluxgate Compass</b> 7.9. Describe the working principle of a fluxgate compass</p> <p><b>Boxing the compass</b> 7.10. "Box the compass" clockwise and counter clockwise from any point in the compass 7.11. Determine the equivalent compass point of the given heading or course and vice versa</p> <p><b>Compass error</b> 7.12. Explain the sources of magnetic and gyro compass and their corrections 7.13. Compute the magnetic compass deviation given values of coefficient</p> <p><b>"Correcting" and "un-correcting" the compass</b> 7.14. Obtain magnetic variation in the nautical chart 7.15. Determine the compass error, variation and/or deviation based on the given values by algebraic and/or graphical method 7.16. Determine the true course and bearing based on the given values by algebraic and/or graphical method</p>	T1, R4, R5, W6, W7, W8	A1, A2, A10



*Annex D3*  
*(NAV 1 – Terrestrial and Coastal Navigation 1)*

*Note: The MHEIs are to develop Part D: Detailed Teaching Syllabus and Instructional Materials (IMs), and Part E: Course Assessment and Assessment Tools (ATs) which satisfactorily meets with the requirements of the course as prescribed in the course outcomes and learning outcomes.*

