

**Registration code – NAUT MET2**

**METEOROLOGY – LEVEL 2**

**Duration – 150 hours**

**Course description**

This is an entry level course designed to provide mariners with a basic knowledge of: the characteristics of the various weather systems, reporting procedures and recording systems; use of meteorological instruments found on board ships; interpretation of weather information; interpretation of a synoptic chart; knowledge of tropical revolving storms; knowledge of ocean current systems; use of appropriate navigational publications on tides and calculation of tidal conditions.

**Required for the following certificates of competencies:**

- Fishing Master, 1<sup>st</sup> Class
- Chief Mate, Near Coastal
- Chief Mate
- Master 3000T, Domestic
- Master 3000T, Near Coastal
- Master, Near Coastal
- Master Mariner

## Learning objectives/competencies

Subject	Knowledge required
<b>Competence:</b>	<b>Forecast weather and oceanographic conditions</b>
<p><b>Ability to understand and interpret a synoptic chart and to forecast area weather, taking into account local weather conditions and information received by weather fax</b></p>	<p><b>The planetary system of wind and pressure</b>            Global systems circulation, seasonal modification and permanent pressure systems; The characteristics and location of the doldrums, ITCZ, Trade winds, Sub tropical oceanic highs, westerlies and polar easterlies; Monsoons, theory of monsoons formation, land and sea breezes compared to monsoons, pressure and weather characteristics associated with, monsoons in the Indian Ocean, the China sea, North coast of Australia and West coast of Africa; The monsoon type weather along the North east coast of Brazil</p> <p><b>The weather associated with the principal air mass types</b>            Formation of air mass; The significance of a Source region; Identification; Characteristics; Modification; Seasonal movement (North America and offshore); Types, continental arctic, continental polar, continental tropical, maritime arctic, maritime polar, maritime tropical, equatorial; Modification of an air mass by the nature of the surface over which it travels; Stable and unstable air masses; Synoptic patterns associated with air mass types The weather associated with air mass types</p> <p><b>Synoptic and prognostic charts and forecasts from any source</b>            Synoptic charts, surface and upper air; Recognition of isobaric distribution patterns; Ability to determine the geostrophic and approximate surface wind speeds from the chart by use of the geostrophic wind scale; Ability to determine the weather associated with specific places within the plots; The rules governing the movement of pressure systems, as given in Meteorology for Mariners to forecast the weather at specific places; The use of prognostic charts; Ability to evaluate the information given in shipping forecasts.</p> <p><b>The Maritime Forecast Code and the range of information available through fax transmissions</b>            Knowledge of information available on weatherfax in Canada and Worldwide; Forecast 12-24 hours, pressure, wind, sea state, visibility, clouds, weather changes; Knowledge of services available; Radio Aids to navigation, Atlantic and Great Lakes, Pacific;</p>

Subject	Knowledge required
<b>Competence:</b>	<b>Forecast weather and oceanographic conditions</b>
	<p>Ability to locate marine weather forecast areas; Understanding weather forecasts for the Great Lakes, ability to use MAFOR code; Assorted weatherfax in weather, satellite, sea state and ice charts; Understanding of synoptic surface analysis charts; Understanding of surface progs; Understanding of wave charts, analysis, forecast; Understanding of ice charts.</p> <p><b>The main types of floating ice, their origins and movements</b></p> <p>Freezing of fresh and salt water; Formation of land ice; Greenland and Antarctic ice caps, glaciers; Ice types and egg code; Type of ice, new, frazil, grease, slush, shuga, nilas, pancake, young, grey, grey-white, first year, second-year, multi-year, fast ice, pack ice, ice of land origin, forms of floating ice (floe sizes); Ice fields and their movement, icebergs and drift, iceberg routes, limits, seasons, reasons for variation in numbers, difference between northern and southern hemisphere icebergs; Presence of icebergs in North Pacific, North Atlantic lane routes, International Ice Patrol.</p> <p><b>The guiding principles relating to the Safety of Navigation in the vicinity of ice</b></p> <p>The signs which may indicate the proximity of ice on clear days and nights; The ranges at which observers may expect to detect ice visually in varying conditions of visibility; The limitations of radar as a means of detecting ice; The precautions to be taken when navigating near ice, and when ice is suspected in vicinity; Avoidance, shelter, warmer water, alteration of course and speed; Thorough knowledge of the content and application of the TP 5064 Ice Navigation in Canadian Waters; Thorough knowledge and ability to use the Canadian Annual Notices to Mariners (Ice navigation section).</p> <p><b>Conditions leading to ice accretion on ship's superstructures, dangers and the remedies available</b></p> <p>Icing of superstructures, causes, fog, freezing drizzle, freezing rain, freezing spray; Action to be taken in the case of serious accumulation of ice;; Ability to use the Mariner's Handbook, for estimating the rate of ice accretion; Methods of avoiding or reducing ice accretion; Reports to be made under International Conventions when ice is encountered; The information to be given in radio messages reporting dangerous ice; The iceberg nomenclature in use by the International Ice Patrol; The information to be given in radio messages reporting conditions leading to severe ice accretion on ship's superstructures.</p>

Subject	Knowledge required
<b>Competence:</b>	<b>Forecast weather and oceanographic conditions</b>
<p><b>Knowledge of the characteristics of various weather systems, including tropical revolving storms and avoidance of storm centres and the dangerous quadrants</b></p>	<p><b>The formation, structure and weather associated with the principal frontal systems</b>  Definitions; Types, stationary, cold, warm, occluded; Movement; Sequence of weather associated with fronts, pressure, wind, temperature, cloud, weather, visibility; Squall lines, definition, association with cold fronts, weather experienced with squall lines, pressure, wind, temperature, cloud, weather, visibility; Areas of occurrence; Local names (e.g., pampero, southerly, buster).</p> <p><b>The formation of, and weather associated with, frontal and non-frontal depressions</b>  Families of depressions: Formation between two air masses, life cycle and movement cross section, associated weather; Frontogenesis; Frontolysis: Secondary depressions; Warm and cold occlusions.</p> <p><b>The formation and weather characteristics of non-frontal weather systems</b>  Definition of “through of low pressure”, both frontal and non-frontal; Ability to draw a synoptic pattern of frontal and non-frontal troughs, for both northern and southern hemispheres, showing isobars, wind circulation and, if applicable, front; Identify a through of low pressure on a surface synoptic or prognostic chart; The weather associated with the passage of a trough of low pressure;  Definition of anticyclone; Ability to draw a synoptic pattern of an anticyclone, for both northern and southern hemispheres, showing isobars and wind circulation; Identify an anticyclone on a surface synoptic or prognostic chart; The general characteristics of an anticyclone; The formation of warm and cold anticyclones; The weather associated with an anticyclone, in summer and winter; Definition of ridge of high pressure; Ability to draw a synoptic pattern of a ridge which is an extension of an anticyclone, showing isobars and wind circulation for northern and southern hemispheres;  Ability to draw a synoptic pattern of a ridge contained between two lows, showing isobars and wind circulation, for northern and southern hemispheres; Identify a ridge of high pressure on a surface synoptic or prognostic chart; The weather associated with both types of ridge of high pressure; Definition of col; Ability to draw a synoptic pattern of a col showing isobars and wind circulation; The weather associated with a col; Ability to draw synoptic patterns showing combination of various isobaric systems.</p>

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	<p><b>Tropical revolving storms</b>  Definition of path, track, vertex or cod, vortex or eye, trough line, angle of indraught, dangerous semi-circle, dangerous quadrant, navigable semi-circle; Features distinguishing it from extra-tropical cyclone, small diameter, steeper pressure gradient, winds tangent to central isobars, eye absence of fronts; Warnings, radio messages, projected track, unusual swell, appearance of the sky, unusual changes in wind strength and direction, corrected drop in barometric pressure;  Weather associated with tropical revolving storms; Sources of energy; Seasonal distribution;  Practical rules for avoidance; Hurricane and typhoon anchorages; Mandatory reporting; Name and season for tropical storms in the following areas: The North Atlantic, the western North Pacific, eastern North Pacific, South Pacific, Bay of Bengal, Arabian Sea, western Indian Ocean, eastern Indian Ocean.</p>
<b>Knowledge of ocean current systems</b>	<p><b>Surface water circulation of the ocean and principal adjoining seas</b>  Definition of set and drift, wind-drift currents, gradient currents, complex currents (including stream currents), Coriolis effect and Ekman’s spiral, upwelling, permanent currents, seasonal currents; General surface circulation and offshoots in North American waters, geographical limits, seasonal variations, direction, strength; Effect of currents on climate, warm, cold; Knowledge of the various currents of the world.</p> <p><b>Voyage planning principles with respect to weather conditions and wave height</b>  Ability to use the data from Ocean Passages of the world; Climatological routeing; Definition of Significant wave height; The factors affecting wave height and direction; The methods employed in forecasting wave heights; Optimum (Least time) routeing; The forms of routeing; The methods of constructing a least time track; The merits of ship and shore based routeing, and their limitations; The construction of ships performance curves; The use on monthly Routeing Charts;  The construction and use of a Baillie wind rose; Demonstrate familiarity with the forms of climatological, meteorological and current data presented in the Sailing Directions (Pilot Books) and in the Mariner’s Handbook.</p> <p><b>The formation of sea waves and swell waves</b>  Difference between seas and swells, definitions of period, height, length, speed, steepness, fetch;  Wave groups, waves in shallow water, ground swell, breakers and surf;</p>

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<b>Competence:</b>	<b>Forecast weather and oceanographic conditions</b>
	Swells in forecasting tropical revolving storms; Effect of coast, wind, currents, tide; Storm surge; Effect of ice on waves, ice crystals, pack ice; Tsunamis and tidal waves, description, epicentre, dangers, tsunami warning system, true tidal waves and tidal bores; Seiche.
<b>Ability to calculate tidal conditions</b>	<b>Apply the relevant weather conditions to tidal calculations</b> The effect of high or low atmospheric pressure on tide levels; The effect of persistent winds on tide levels and tidal times; The effect of abrupt changes of weather conditions on tidal levels; The origin and areas of prevalence of seismic waves.
<b>Use all appropriate navigational publications on tides and currents</b>	<b>Apply tide and current data from nautical publications and charts</b> Ability to use tidal height calculations in passage planning, with regard to limiting draughts and times of available depth of water; Ability to use tidal stream information in passage planning, with regard to effect on course made good, and effect on speed, timing of events; Ability to use current information in passage planning, with regard to effect on course made good, and effect on speed, timing of events.