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CHAPTER 10 - MASTER MARINER

PART I - GENERAL REQUIREMENTS OF APPLICANTS

10.1 (1) Every applicant for a certificate as Master Mariner shall:

(a) either

(i) obtain:

(A) a certificate of completion for the three-year course set out in TP 5562 at a school listed in TP 10655; and

(B) a minimum of 30 months service when approval for graduation is granted to First Mate, Intermediate Voyage, as officer in charge of the watch as follows:

(aa) a minimum of 12 months service after obtaining a certificate as Master, Intermediate Voyage, as officer in charge of the watch on ships of at least 200 tons gross tonnage making voyages extending beyond partially smooth water limits;

(bb) a minimum of 12 months sea service after obtaining a certificate as First Mate, Intermediate Voyage, as officer in charge of the watch on ships of at least 200 tons gross tonnage making foreign voyages or voyages including a deep-sea passage; and

(cc) the remaining service made up of service after obtaining a certificate as Watchkeeping Mate, Ship, as officer in charge of the watch on ships of at least 25 tons gross tonnage making voyages extending beyond partially smooth waters;

or

(ii) complete 36 months service as follows:

(A) a minimum of 12 months service after obtaining a certificate as Master, Intermediate Voyage, as officer in charge of the watch on ships of at least 200 tons gross tonnage making voyages extending beyond partially smooth water limits;

(B) a minimum of 12 months sea service after obtaining a certificate as First Mate, Intermediate Voyage, as officer in charge of the watch on ships of at least 200 tons gross tonnage making foreign voyages or voyages including a deep-sea passage; and

(C) the remaining service made up of service after obtaining a certificate as Restricted Watchkeeping Mate, Ship, or Watchkeeping Mate, Ship, as officer in charge of the watch on ships of at least 25 tons gross tonnage making voyages extending beyond partially smooth waters;


(b) obtain a medical certificate prescribed by the Crewing Regulations;

- (c) obtain a certificate of completion for each of the following courses from a school or organization listed in TP 10655:
 - (i) Marine Emergency Duties Course, Senior Officer (D) set out in TP 4957;
 - (ii) Simulated Electronic Navigation Course Level II, set out in TP 4958; and
 - (iii) Marine First Aid Advanced Course, set out in TP 13008;
 - (d) pass a written examination in each of the following subjects:
 - (i) Navigation Instruments;
 - (ii) Engineering Knowledge;
 - (iii) Ship Management; and
 - (iv) Naval Architecture/Stability;
 - (e) pass a practical examination on Simulated Electronic Navigation Level II; and
 - (f) pass an oral examination in General Seamanship.
- (2) Service with a First Mate, Foreign-Going, or Master, Home-Trade certificate will be accepted in lieu of service with a Master, Intermediate Voyage, certificate.
- (3) Except as stated in subsection (1)(a)(i)(B) an applicant for oral examination 164 for a Master Mariner certificate shall have completed a total of at least 36 months service as officer in charge of the watch, of which at least 12 months shall have been served on vessels making foreign-going voyages or voyages including deep-sea passage as described in section 3.10. This 12-month period shall have been served while holding a First Mate, Intermediate Voyage; First Mate, Home-Trade; or Second Mate, Foreign-Going; certificate on vessels of at least 200 tons gross tonnage. The remaining 24 months service shall have been served in two periods of not less than 12 months each as officer in charge of the watch while holding a certificate not lower than First Mate, Foreign-Going, or Master, Home-Trade and Restricted Watchkeeping Mate, Ship, or Second Mate, Home-Trade, on vessels of at least 200 tons and 25 tons gross tonnage, respectively, making voyages beyond partially smooth water limits.

PART II - EXAMINATIONS

10.2 (1) The following table lists the examinations for the Master Mariner Certificate, the qualifying service required before each may be attempted, and other requirements. Subjects 023, 134 and 141 are academic, and demand no prerequisites.

Examination	Qualifying WK Service While Holding Master, Intermediate Voyage	Other Requirements
023 Navigation Instruments	Nil	Nil
093 Ship Management	Nil	Passed 092
114 Naval Architecture/Stability	Nil	Passed 113
134 Engineering Knowledge	Nil	Nil
164 General Seamanship	12 months	All other exams must have been passed before attempting 164.

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- 10.3 (1) The examination system is modular, therefore the examinations associated with necessary lower-grade certificates are as much a part of the requirements for a Master Mariner certificate. The holders of Master, Intermediate Voyage, certificates are straightforward cases covered by Section 10.2. For holders of 1MFG and CHT, the appropriate examinations listed in sections 13.4, 12.2 and 11.2 also must have been passed or credited.
- (2) Applicants for the Master Mariner Certificate under subsection 10.1 (2) who hold 1MFG or CHT certificates will receive credits as set out in Appendix F of this publication against the examinations associated with the lower-grade certificates.
- (3) If qualifying certificates were passed before March 1983, applicants for Master Mariner will be examined in the Collision Regulations with Canadian Modifications 1983.

PART III - VALIDITY OF CERTIFICATE

10.4 The Master Mariner Certificate is valid as master of a foreign-going ship.


PART IV - SYLLABUSES OF EXAMINATIONS

10.5 **Navigation Instruments**
Examination number 023

ITEM	COLUMN
1.	Electricity Correct identification of faults and knowledge of precautions to guard against the hazards associated with electrical equipment.
2.	Signal Manipulation Knowledge of the techniques used to generate, modulate, detect and amplify radio frequency electromagnetic signals; the effect of modulation technique, band and band width on signal quality and detectability; the need for and characteristics of common marine antenna types.
3.	Radio-Communication Equipment Knowledge of specific principles, practical application and operation of typical radio-communication equipment in current service.
4.	Radio-Communication Systems Thorough knowledge of the regulatory requirements for marine radio-communications systems; VTMS and distress and safety systems; organization and operating protocols of satellite and terrestrial marine communication systems for ship stations, satellite systems and terrestrial systems.
5.	Time Knowledge of the nature of time measurement systems in use by electronic position fixing systems; relationship between time measurement systems and the effect of the measurement systems used on positional data.


6.	<p>Global Coordinates and World Geodetic System (WGS)</p> <p>Knowledge of coordinate system data in use by electronic position fixing systems; relationship between coordinate systems and the effect of coordinate system choices on positional data.</p>
7.	<p>Navigation Appliances</p> <p>Thorough knowledge of the regulatory, physical, operational and operator requirements of marine electronic navigation systems.</p>
8.	<p>Electronic Aids to Navigation</p> <p>Knowledge of principles of operation of marine electronic navigation aids, including depth-measuring systems (Sonar); Doppler position-fixing systems; elementary knowledge of Doppler, its use in position fixing, distance and velocity measurement; characteristics, applications, errors, coverage areas and limitations of GPS, DGPS, GLONASS and Global Navigation Satellite System.</p>
9.	<p>High-Precision Position-Fixing Systems</p> <p>Knowledge of principles, practical application and operation of high-precision position-fixing systems, including Trisponder, Mini-Ranger, Decca Hi -Fix/6, Syledis B, Raydist, Argo, MRD-1, and Trident III.</p>
10.	<p>Integrated Bridge Systems</p> <p>Ability to assess the benefits of integrated systems of navigation to particular vessel operations and identify the integrity of the information provided from the data inputs available, with particular reference to data requirements and quality.</p>
11.	<p>Electronic Charting</p> <p>Knowledge of the principles, practical application and operation of electronic charting and display systems.</p>
12.	<p>Voyage Management Systems</p> <p>Knowledge of the principles, practical application and operation of management systems.</p>
13.	<p>Dynamic Positioning Systems</p> <p>Knowledge of the principles, practical application and operations of dynamic positioning using taut wire, acoustic, heading reference, radar, HPNS, INS and GPS methods.</p>

Note: The student should recognize the fallibility of all electronic aids, and the importance of combining different methods and possessing a continuing ability and preparedness to fall back on basic, non-electronic navigation methods at any time.
The examination consists of descriptive and calculation exercises.
Duration is three hours.

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10.6 Ship Management
Examination number 093

ITEM	COLUMN
1.	Marine Insurance Extended knowledge of marine insurance and its inter-relationship with charter parties, bills of lading and the <i>Marine Liability Act</i> ; insurance and salvage agreements; and mutual insurance (P & I Clubs), including risks covered by P & I Clubs.
2.	General and Particular Average, York Antwerp Rules Extended knowledge of general average, particular average and York Antwerp rules; port of refuge, including justifiable deviation; responsibility of master in case of deviation; differences between particular average and general average.
3.	Charter Parties and Bills of Lading Extended knowledge of charter parties and bills of lading with respect to international marine laws, and a general appreciation of the interpretation of agreements.
4.	Statutory and Contractual Requirements Regarding Seaworthiness Knowledge of seaworthiness as contained in the <i>Canada Shipping Act</i> ; appreciation of SOLAS and related regulations; recognition of international convention on loadlines and Load Line Regulations; appreciation of ILO/ SOLAS minimum standards for merchant ships; awareness of STCW continuous-proficiency requirements; right of national administrations to prevent the sailing of an unsafe vessel; port state control; knowledge of provisional certificates of registry, interim certificates of class, allowances for limited voyages, and associated inspection procedures.
5.	Deviation and its Effects on Various Contracts Putting into port of refuge or returning to loading port; justifiable deviation; common law warranties.
6.	Functions and Jurisdiction of IMO, ILO and SOLAS Conventions Outline of IMO; convention procedures; signatory requirements; examples of international conventions; outline of SOLAS; outline of ILO; <i>International Seafarers Guide</i> and Joint Maritime Commission.
7.	National Jurisdictions, Local Legislation and Labour Relations Working appreciation of the <i>Canadian Labour Code</i> ; awareness of the <i>Canadian Criminal Code</i> as it relates to vessel operation and safety; appreciation of the collective bargaining process for unions and associations; ability to observe/interpret collective agreements; awareness of right and/or limitation of access of unions and associations to vessel within or without collective agreements; appreciation of the effective expedition of a progressive disciplinary procedure and the associated documentation; awareness of the <i>Ports and Harbours Act</i> and recognition of port by-laws as they relate to vessel operation.
8.	General Organization of Ship Management Working appreciation of concepts, theories and practices of organizational management; complete knowledge of various types of articles of agreement; procedures related to signing-on and signing-off crew; station bills and emergency procedure plans; appreciation of documentation and record keeping; knowledge of loadline regulations; maintenance of safety equipment and machinery; systematic approaches to vessel safety and environmental protection; complete knowledge of the functions of classification societies; customs and immigration procedures and legislation; appreciation of the use of passports and visas in foreign ports; awareness of IMO standard vessel forms for stores, crew and passenger list; review of Safe Working Practices Regulations and Tackle Regulations with emphasis on inspection, testing and documentation practices; knowledge of implications and procedures associated with change of flag and/or ownership; understanding of the <i>Coasting Trade Act</i> and an appreciation of procedures for a vessel purchased abroad, flagged to Canada and operated in the Canadian coasting trade; awareness of the master's duties and responsibilities under the Quarantine Regulations and the Ship Fumigation Regulations; working knowledge of practices and protocols regarding disputes, claims, liens and arrests as they relate to the vessel, charter and cargo; knowledge concerning procurement of legal advice for conflict of interest.

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9.	<p>Port State Control Appreciation of the scope of authority of Port State Control and recognition of the right of national administrations to inspect and detain vessels for infractions.</p>
10.	<p>Crew Welfare and Training Knowledge of marine-safety approved training schemes; licensed and non-licensed crew certificate requirements; marine occupational safety and health (OSH) legislation; controlled-substance legislation and proposed American regulations; employee assistance programs, conditions of employment, rights of employees and testing; appreciation of the <i>Worker's Compensation Act</i>; the Workplace Hazardous Materials Information System (WHMIS); and appreciation of the <i>Merchant Seamen's Compensation Act</i>.</p>
11.	<p>Crew Representation and Rights of Seamen Under CSA Knowledge of right to have copy of agreement posted; right to be consulted if an alteration is made in an agreement; various types of agreement; right to have wages paid; master's obligation to provide seafarer facilities to remit wages; compensation where improperly discharged; right to sue for wages; master's obligation to permit seafarer ashore to lodge complaints; awareness of the <i>Canadian Charter of Rights</i>.</p>
12.	<p>Accounting and Charter Party Appreciation of wage calculations and profit/loss considerations concerning lay days, demurrage, dispatch, freight.</p>
13.	<p>Vessel Traffic Services (VTS) and Reporting System Knowledge of Canadian VTS and information systems; reporting systems, national/international; ECAREG, NORDREG, AMVER, MAREP; master's obligation to report dangers to navigation; traffic schemes and IMO approval procedure; limitations of vessel traffic services; limitations concerning use of inshore lane.</p>
14.	<p>Industrial and Environmental Safety Working knowledge of Oil Pollution Prevention Regulations; recognition of International Convention for Prevention of Oil Pollution from ships, MARPOL; appreciation of master's responsibilities and liabilities under the Garbage Pollution Prevention Regulations, <i>Arctic Waters Pollution Prevention Act</i>, Dangerous Goods Shipping Regulations, <i>Navigable Waters Protection Act</i>, Arctic Shipping Pollution Prevention Regulations, and the <i>Canadian Environmental Protection Act</i>.</p>
15.	<p>Compulsory and Non-Compulsory Pilotage Legal aspects of compulsory and non-compulsory pilotage; pilot's responsibility to master; when a pilot shall not pilot; pilotage exemptions; working knowledge of the practical aspects of transit through the Panama and Suez canals.</p>
16.	<p>Functions of Consular Offices Working knowledge of the purpose and functions of consular offices; appreciation of the conduct of a vessel under a foreign jurisdiction.</p>
17.	<p>Shipping Casualties Knowledge of responsibilities and procedures under the Shipping Casualties Reporting Regulations; awareness of shipping inquiries and investigation rules; the Transportation Safety Board and its authority; appreciation of the composition of technical reports, damage reports, repair specifications; noting and extending protest, and procurement of an attorney.</p>

Note: The examination consists of seven essay and calculation questions of which five must be answered.
Duration is three hours.

10.7 Naval Architecture
Examination number 114

ITEM	COLUMN
1.	Inclining Experiment Purpose of the experiment; practical details of the procedure and resulting calculations; precautions to be observed to ensure a reliable and accurate result.
2.	Effect of Free Surface of Liquids Importance of this effect; development of the formula determining this effect, and the use of the formula in a given instance; practical limitations of the formula dependent on the unchanging extent of the free surface.
3.	Dynamical Stability Definition and understanding of the relationship between dynamical and static stability; the development of Moseley's formula for dynamical stability and calculations of dynamical stability at a specified angle of inclination by using the stability curve; understanding of cross curves and hydrostatic curves.
4.	Static Stability Stability and trim when grounding, docking, undocking or refloating; suitable conditions of stability and trim prior to docking; critical period and critical instant of docking; calculation of effective GM; calculation of the effect on a vessel's GM as a result of grounding on a falling tide.
5.	Shift in or Loss of Cargo Calculations of alteration of draft, trim and stability from shift in or loss of cargo.
6.	Stability in Negative GM Condition Development of wall-sided formula and its use in a given instance to determine the angle of loll and the value of associated GM.
7.	Effect of Beam and Freeboard on Stability Effect of increase or decrease of beam, considered in isolation, on initial value, maximum value, range and shape of the stability curve; effect of increase or decrease of freeboard, considered in isolation, on initial value, maximum value, range and shape of stability curve; effect of beam, block coefficient and speed on squat.
8.	Waves and Ship Motion Application of simple harmonic motion (SHM) analysis to the rolling of a ship with recognition of the limitation of this theoretical approach; application of the formula of this method for the rolling period with calculations; trochoidal wave theory as a close approximation of the behaviour of deep sea waves; virtual gravity and virtual upright and their relationship to true gravity and upright; application of formulas relating wave lengths to wave period and speed, as derived by the theory, motion and characteristics in shallow water and canal transits.
9.	Stability in Damaged Condition Meaning of the following terms used in the subdivision rules and their application: margin line, permeability, bulkhead deck, maximum permissible length, floodable length, curves of floodable length, and criterion of service. Knowledge of the general method employed in these rules, and calculations of trim and stability following an accidental flooding.
10.	Pressure in Liquids Calculation of total pressure on an immersed plane surface of a regular geometric form that is oriented parallel to, vertical to, or at an angle to the surface of the liquid; and the development of the formula locating the centre of pressure of the surface, with related calculations.
11.	Stress Diagrams Ability to understand and make use of the stress diagrams, as supplied, and to perform loading calculations including alternate hatch-loading shear stresses.

Note: The examination consists of descriptive questions and calculation exercises that permit the applicant some options.
Duration is three hours.

10.8 Engineering Knowledge
Examination number 134

ITEM	COLUMN
1.	Steam Boilers Knowledge of conditions for ideal combustion; fuel-oil burning arrangements; closed-feed system; boiler construction; and auxiliaries.
2.	Steam Turbines Knowledge of impulse and reaction turbines; requirements, precautions and procedures for warming through; applications for impulse and reaction turbines; axial thrust, including how axial thrust is taken up in reaction turbines; materials used for the major components of steam turbines; purpose of nozzles used in steam turbines.
3.	Gas Turbines Knowledge of principles of operation of a gas turbine; materials used in the major components of a gas turbine; marine-based applications of the gas turbine.
4.	Internal Combustion Engines Knowledge of the operation of a diesel engine and spark-ignition engine; differences between diesel and spark-ignition engines; fuel system including the fuel supply from the DB to the engine; indicator cards in IC engines and information that can be obtained from draw cards and timing diagrams in IC engines; turbocharging two- and four-stroke cycle diesel engines; cooling systems and lubricating systems; sea-water cooling systems, including problems associated with seawater when operating a vessel in ice; method of recirculating seawater and precautions to be taken; recommended sequence for starting, stopping and reversing of a large main diesel engine; turbo and diesel electric propulsion.
5.	Pumps Knowledge of the action, operation and application of centrifugal, displacement, gear pumps and positive-displacement reciprocating-piston type pumps in the machinery space or pump room of a modern ship.
6.	Drive Systems Knowledge of thrust and trailing blocks; reduction gearing; electromagnetic or hydraulic coupling for two or more main engines on One Shaft; flexible couplings; and dry clutch system.
7.	Refrigeration Knowledge of the fundamental principles of heat transfer with respect to vapour compression systems; the operating cycle of a vapour compression system; the operating cycle of an absorption type refrigeration unit; characteristics of refrigerants found in marine applications; arrangement details for insulation.
8.	Remote-Control Systems Knowledge of machinery space control systems (pneumatic, electric, hydraulic, electro-hydraulic); data logging utilizing digital systems; alarm and fail-safe systems in a machinery space and bridge instrumentation; bridge control systems (local and remote) with remote systems for application in navigation; computer-control loading systems on VLCC/chemical product carrier, self-unloading bulk carrier, LNG/LPG vessels.
9.	Hydraulic Systems Knowledge of the operation and application of pumps and motors and hydraulic drives commonly used in marine applications.

10.	Vibration Knowledge of major sources of vibration in ships; natural vibration, forced vibration and resonance; generation of harmonic motion and details of their compensation; effect of draft and speed; vibration monitors; critical speed and techniques used to counter critical speed in rotating machinery.
11.	Air Receivers Knowledge of the function, limitations and purpose of air receivers and fittings; dangers associated with and precautions that must be taken when using an air receiver.
12.	Engine Power Knowledge of the equation for power development, including the relationship between indicated power (IP), frictional power (FP) and brake power (BP); determine how mechanical efficiency is found for a diesel engine.
13.	Propellers Knowledge of the method of checking the pitch of a propeller; how the propeller transfers shaft power into thrust; relationship between pitch and power; operation of a typical CPP system.
14.	Materials Knowledge of effects of temperature on metals; principles of galvanic corrosion on a vessel; method of cathodic protection; method of impressed current system; how design and maintenance can alleviate considerable corrosion on marine vessels.
15.	Vessels Operating in Ice Knowledge of machinery operation considerations when navigating in ice; methods of freeing a vessel from ice utilizing pumping of tanks or flume system.

Note: The examination consists of descriptive questions that permit the applicant some options.
Duration is three hours.

10.9 Not in use.

10.10 General Seamanship
Examination number 164

ITEM	COLUMN
1.	<p>Ship Handling and Manoeuvring</p> <p>Practical knowledge of handling and manoeuvring a ship in unusual circumstances; retrieval of man overboard; procedures in ice, alone or in a convoy and movements to be expected by an ice breaker with reference to Transport Canada (TC) publication <i>Ice Navigation in Canadian Waters</i>; search and rescue procedures, responsibilities of the on-scene commander, with reference to MERSAR, CANMERSAR and TC publications; precautions to be taken in bad weather; tables of stopping distances, turning circle diagrams and derivation of appropriate information on ship characteristics; controlled-pitch propeller or propellers, transverse thrust, turning ahead or astern; vessel pivoting point when manoeuvring with headway and sternway; head reach and stern reach; the effect of cavitation and wake current; rudder force and the manoeuvring of twin screws; sail effect of vessel superstructure; berthing, unberthing and use of the water wedge in ship handling; locking and unlocking a vessel; anchoring to a single bower anchor; anchoring to a stern anchor; mooring to two anchors; mooring to buoy; turning a vessel short round; bank suction and cushion effect in narrow channels; the effect of shallow water resistance on ship behaviour; mooring lines and ground tackle in all circumstances; the use of tugs in manoeuvring.</p>
2.	<p>Handling and Managing a Ship Under Exceptional Circumstances</p> <p>Loss of or damage to rudder and the use of auxiliary means of steering; steering by screws; rigging jury rudder or jury steering gear, damage control in case of collision, grounding, fire, explosion or other accident; procedure when grounded and methods of refloating; procedure when beaching a vessel, procedure in case of wreck with emphasis on preservation of life; methods of abandoning a wrecked vessel; steps to be taken when disabled and in distress; taking and being taken in tow; rescuing crew of a disabled vessel or person in the water; manoeuvring in bad weather; heaving to and running before a sea; the dangers of being pooped; keeping head to sea; the use of oil in bad weather and rescue operations; keeping a disabled vessel out of trough and lessening lee drift.</p>
3.	<p>Dry-docking</p> <p>Procedures and precautions observed when dry-docking; effect of distribution of weight, dry-docking with a full cargo, and the use of bilge blocks, shores and cradles; dry-dock inspections, fire prevention, ship services, security and precautions to be observed in dry-dock; procedure to be followed prior and during refloating.</p>
4.	<p>Management and Law</p> <p>Duties, obligations and responsibilities of the master on vessels making international voyages in compliance with national and international rules and regulations including port state control; on first joining a vessel; official documents on board a vessel; issuance and understanding of standing, general, night and special orders; berthing and unberthing under all conditions; manoeuvring a vessel and assessing risks involved; under way, in port or at anchor under all circumstances and conditions; shipboard, local and general emergencies of any nature; verifying information on the ship's manoeuvring characteristics, determining approximation manoeuvring data and recording the vessel's manoeuvring peculiarities; setting and manning the watches according to regulations, ordinary practice of seafarers and during exceptional circumstances; organizing the crew and other persons for routine operation and emergencies of all kinds; maintaining equipment in good operating condition; dealing with non-Canadian ports and authorities.</p>
5.	<p>Regulations and Codes</p> <p>Collision Regulations with Canadian Modifications 1983; navigating procedures, practices, regulations and codes; safe working practices; the <i>Canada Labour Code</i>.</p>

Note: The examination is taken from the syllabuses for Watchkeeping Mate, Ship; First Mate, Intermediate Voyage; and Master, Intermediate Voyage orals, and the answers must reflect the additional experience, responsibilities and studies at the Master Mariner level.
The examination is oral and practical.
Duration as necessary.