VALIDATION OF MODEL TRAINING COURSES

Model Course – Officer in Charge of a Navigational Watch

Note by the Secretariat

SUMMARY

Executive summary: This document provides the draft of a revised model course on Officer in Charge of a Navigational Watch

Strategic direction: 5.2

High-level action: 5.2.2

Planned output: 5.2.2.5

Action to be taken: Paragraph 3

Related document: STW 40/14

1 Attached in the annex is a revised draft model course on Officer in Charge of a Navigational Watch.

2 As instructed by the Sub-Committee at its forty-third session, this model course was referred to the course coordinators for further revision, to reflect closely the requirements of the 2010 Manila Amendments.

Action requested of the Sub-Committee

3 The Sub-Committee is invited to consider the above information and take action, as appropriate.

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ANNEX

DRAFT IMO MODEL COURSE ON OFFICER IN CHARGE OF A NAVIGATIONAL WATCH

(Note: deleted text in strikethrough and new text in shadow)

COURSE 7.03
OFFICER IN CHARGE OF A NAVIGATIONAL WATCH
ACKNOWLEDGEMENTS

This course for Officer in Charge of a Navigational Watch is based on material developed by Anglo Eastern Maritime Training Centre, Mumbai, India and Malaysian Maritime Academy for IMO under the guidance of GlobalMET.

IMO wishes to express its sincere appreciation to GlobalMET for its provision of expert assistance, valuable cooperation, and generous funding in support of this work.
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Part A 1: Course Framework

**Aims**
This model course aims to meet the mandatory minimum requirements for the:

i) knowledge, understanding and proficiency in Table A-II/1 of STCW 2010, for Function 1: Navigation at the Operational Level.

ii) knowledge, understanding and proficiency in Table A-II/1 of STCW 2010 for Function 2: Cargo Handling and Stowage at the Operational Level.

iii) knowledge, understanding and proficiency in Table A-II/1 of STCW 2010 for Function 3: Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level.

**Objectives**

**Function 1: Navigation at the Operational Level**

This syllabus covers the requirements of the STCW 2010 Convention Chapter II, Section A-II/1. This functional element provides the detailed knowledge to support the training outcomes related to Navigation at the Operational Level.

This section provides the background knowledge to support:

- planning and conducting of a passage and for determining position, including: celestial navigation terrestrial and coastal navigation electronic systems of position fixing and navigation echo-sounders and speed measurement compass - magnetic and gyro steering and control systems meteorology

- maintaining a safe navigational watch

- use of radar and ARPA to maintain safety of navigation*

- use of AIS to maintain safety of navigation*

- use of ECDIS to maintain the safety of navigation*

- responding to emergencies

- responding to a distress signal at sea
- use of the standard marine navigational vocabulary – IMO standard marine communication phrases
- transmission and receipt of information by visual signaling
- manoeuvring the ship.

**Function 2: Cargo Handling and Stowage at the Operational Level**

This syllabus covers the requirements of the STCW 2010 Convention Chapter II, Section A-II/1. This functional element provides the detailed knowledge to support the training outcomes related to Cargo Handling and Stowage at the Operational Level.

This section provides the background knowledge to support:

- monitoring the loading, stowage, securing and unloading of cargoes and their care during the voyage.
- inspecting and reporting defects and damage to cargo spaces, hatch covers and ballast tanks.

This includes topics such as ship stability, deck cargoes, containers, bulk cargoes, grain, dangerous goods and oil tankers.

**Function 3: Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level.**

This syllabus covers the requirements of the STCW 2010 Convention Chapter II, Section A11/1. This functional element provides the detailed knowledge to support the training outcomes related to Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level.

This section provides the background knowledge to support:

- compliance with pollution-prevention requirements
- maintaining the sea-worthiness of the ship, including:
  - ship stability
  - ship construction
- prevention, control and fighting of fires on board ship*
- operation of life-saving appliances*
- provision of medical first aid on board ship*
  - monitoring compliance with legislative requirements
  - leadership and team working skills*
  - contribution to safety of personnel and ship*
This function includes topics such as ship stability, carriage of cargoes on deck, heavy lifts, containers, bulk cargoes, grain, dangerous goods, oil tankers and the IMO conventions.

* These topics are covered in separate IMO model courses.

**Entry standards**

This course is principally intended for candidates for certification as officer in charge of a navigational watch. Those wishing to enter this course should be following an approved programme of shipboard training. Alternatively, trainees may complete approved seagoing service of not less than three years.

**Course certificate**

On successful completion of the course and assessments, a document may be issued certifying that the holder has successfully completed a course of training which meets or exceeds the level of knowledge and competence specified in Table A-II/1 of STCW 1995 2010, for each or all of the following functions

  1. Navigation at the Operational Level.
  2. Cargo Handling and Stowage at the Operational Level
  3. Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level

A certificate may be issued only by centres approved by the Administration.

**Staff requirements**

Instructors shall be qualified in the task for which training is being conducted and have appropriate training in instructional techniques and training methods (STCW Code Section A1/6). Depending on the complexity of the exercises set, an assistant instructor with similar experience is desirable for certain practical exercises. Administrations shall ensure that the qualifications and experience of instructors and assessors are covered in the application of the quality standard provisions of section A-I/8. Such qualification, experience and application of quality standards shall incorporate appropriate training in instructional techniques, and training and assessment methods and practice, and shall comply with all applicable requirements of paragraphs 4 to 6 of Section A-1/6 of STCW Code.

**Teaching facilities and equipment**

A classroom equipped with an overhead projector and a blackboard (or whiteboard) or flipchart should be provided for teaching the theory of the course and holding group discussions.

**Function 1**

For chartwork exercises the trainees need desks, approximately 1.0 m long x 0.7 m deep, with drawers under for storage of charts.
The trainees should, for training purposes, have access to:
- a binnacle with magnetic compass and sighting device
- a gyro-compass and pelorus
- sextants

The following equipment is required for each trainee:
- protractor and dividers
- parallel ruler
- pocket calculator with trigonometric functions and sufficient memory capacity
to calculate altitude using the cosine formula and/or nautical (logarithmic) tables
- pre-computed altitude and azimuth tables
- Nautical Almanac
- chart of the coastal area in which the education is taking place
- chart off the coast; for instance, Admiralty chart no.1875
- ocean plotting sheet

COLREG - A set of table-top models, displaying proper signals or lights, or a magnetic board or navigation light simulator is required for teaching and exercising the collision regulations.

Meteorology - for training purposes it is desirable to have meteorological instruments such as a thermometer, hygrometer, mercurial barometer, and aneroid barometer and a radio receiver. A facsimile receiver would also be useful if available.

Emergency procedures - either a dummy line-throwing apparatus or, if there is sufficient open space where one may safely be used, a complete working apparatus with a supply of rockets and lines.

Visual Signalling - A Morse key connected to a light, mounted high enough to be easily visible from all points of the room or a computer based system, should be provided. Blinds or curtains may be required to prevent direct sunlight interfering with reading the light.

International Code of Signals - for teaching the use of the Code, a set of rigid code flags with a mast to which they may be attached to represent hoists or computer based system is needed.

Manoeuvring - a set of models to represent ships, jetties, piers and other dock configurations, which can be used on a table top to illustrate ship berthing procedures, should be provided. Unless competence is to be demonstrated in ships during service or in a training ship, a suitable ship handling simulator or manned ship models will be required. A model showing the windlass and mooring arrangements should be provided for demonstrating anchoring and mooring procedures. The seamanship area should be equipped with lengths of ropes and wires, together with stoppers and various types of shackles, for purposes of illustration.
Teaching aids (A)
A1 Instructor Guidance (Part B of this course).
A2 Catalogue of British Admiralty Charts and other Hydrographic Publications.
A3 British Admiralty Notices to Mariners.
A4 Chart.
A5 Deviation Table.
A6 British Admiralty List of Lights.
A7 National List of lights and Buoyage System.
A8 British Admiralty Tide Table of the area concerned.
A9 National tide table.
A10 Tidal stream atlas.
A11 British Admiralty 'Pilot' book for the area concerned.
A12 National sailing directions.
A13 Star Finder and Identifier HO 21 01-D.
A14 Nautical Almanac.
A15 Pilot chart of the ocean concerned (US Hydrographic Office publication).
A17 Ocean plotting sheet.
A18 Distance Tables.
A20 Admiralty List of Radio Signals, Vol. 3 6 (NP283) and Diagrams relating to Weather Reporting and Forecast Areas (NP283(a)). Taunton, Hydrographer of the Navy.
A23 Nautical table (Norie's, Burton's or other).
A24 Star Chart.
A25 Pre-computed altitude and azimuth table.
A26 Pocket Calculator.
A27 Loran-C receiver.
A28 GPS Receiver.
A29 Echo sounder.
A30 Speed Log.
A31 Magnetic Compass.
A32 Gyro-Compass.
A33 Automatic Pilot.
A37 Video cassette player and/or DVD player.
A39 Differential GPS (DGPS) Receiver.
A40 Enhanced Loran (eLoran) Receiver.
A41 Automatic Identification System (AIS) Receiver.
A42 Long Range Identification and Tracking (LRIT) Receiver
A43 Voyage Data Recorder (VDR) and Simplified Voyage Data Recorder (S-VDR)
A44 Bridge Navigational Watch Alarm System (BNWAS)
A45 Simulators (wherever applicable to enhance understanding of topics, especially, COLREGS and Ship Handling)

Video-cassettes, CDs and DVDs
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V2 Preparing the defence (IMO Code No. VID-301)

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Fax: +44 20 7587 3241
URL:www.imo.org

V3 Know the current rules (Code No.328)
V4 Bridge watchkeeping – Part 2 (Code No 497)
V5 Passage planning (Code No 496)
V6 Search and rescue: co-ordination (Code No 574)
V7 Man overboard (Code No 644)
V8 Theory of mooring (Code No 615)
V10 Safe Mooring Practice – Edition 4 (Code No. 1105)
V11 Maintenance of Mooring Systems - Edition 4 (Code No. 1106)
V12 Basic instincts (Passenger Mustering & Crowd Control) (Code No 603)
V13 Navigational Charts & Associated Publications - Part 6, Code No: 639
V14 The Safe Use Of Electronic Charts, Code No: 705
V15 AIS - Automatic Identification Systems, Code No: 926
V16 Ship Handling - Part 1, Code No: 95
V17 Ship Handling - Part 2, Code No: 129
V18 Ship Handling - Part 3, Code No: 321
V19 Ship Handling in Restricted Waters - Ship Squat And Shallow Water, Code No: 697
V20 Ship Handling In Restricted Waters - Bank Effect & Interaction, Code No: 748
V21 Working With Tugs, Code No: 972
V22 Pilot on Board! Working Together, Code No: 945
V23 Working With VTS - Part 7, Code No: 640
V24 Anchoring Safely, Code No: 928
V25 Meteorology for Safe Navigation in Cyclones, Code No: 695
V26 Wind, Waves and Storms Part 1 - Understanding Weather System, Code No 738
V27 Wind Waves and Storms Part 2 - Coping With Hazardous Weather, Code No 743
V28 Collision Avoidance CD-Rom (Version 1.7), Code No: 819
V29 Helicopter Operations at Sea (Edition 2), Code No: 704
V30 Gyro Compass - Part 1, Code No: 9897
V31 Gyro Compass - Part 2, Code No: 9898
V32 Gyro Compass - Part 3, Code No: 9899
V33 Ship handling in head seas (Code No 661)
V34 Manoeuvring Characteristics of Special Car Carriers (Code No 696)
V35 Manoeuvring and Control Characteristics of Special Type Ships: Part 1
  Focusing on the Wind Pressure Effect on A PCC (Code No 9985)
V36 Manoeuvring and Control Characteristics of Special Type Ships: Part 2
  Anchoring And Mooring Of A PCC (Code No 9986)
V37 Tractor Tugs (Code No 165)
V38 Shiphandling With Tractor Tugs (Code No 359)
V39 Navigating In ICE (Code No 927)
V40 Margins Of Safety (Code No 73)
V41 Voyage Planning (Code No 758)
V42 Master/Pilot Relationship (Code No 498)
V43 Accident Prevention - The Human Factor (Code No 637)
V44 Emergency Procedures (Code No 638)
V45 Navigational Charts & Associated Publications (Code No 639)
V46 Five Case Studies (Code No 781)
V47 Shipping Casualty Emergency Response (Code No 467)
V48 The Cold And Heavy Weather File (Code No 626)
V49 Target Tracking Devices (Code No 948)
V50 Watchkeeping In Port Code No: 659
V51 Dangerous Goods At Sea Series (Edition 5) (Code No 713)
V52 Dangerous Goods At Sea Series Part 2 (Edition 5) (Code No: 719)
V53 Centrifugal pumps - theory & operation (Code no: 9)
V54 Crude oil washing operations (edition 3) (code no: 707)
V55 Operation & maintenance of inert gas systems (edition 3) code no: 708
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V57 Safe cargo stowage & securing code no: 747
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V58 Successful reefer container operations code no: 788
V59 Bulk carriers - handle with care code no: 691
V60 Hatch covers - a practical guide code no: 938
V61 Chemical tank cleaning & inspection (edition 2) code no: 950
V62 Chemical tanker operations: safety and pollution prevention part 1 code
  no: 951
V63 Chemical tanker operations: safety and pollution prevention part 2 code
  no: 952
V64 Tank cleaning practice code no: 982
V65 Over and under pressurisation of tanks (edition 2) code no: 984
V66 Handling vegetable oils code no: 988
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V67 Dangerous & difficult bulk cargoes code no: 1101
V68 Vapour emission control code no: 1118
V69 Ro-Ro safety and cargo operations code no: 162
V70 Portable tanks and tank containers code no: 314
V71 Reefer container operations code no: 481
V72 Fire fighting & safe cargo operations on car carriers code no: 540
V73 Don't gamble with safety on chemical tankers code no: 595
V74 Cargo loss prevention on board bulk carriers code no: 598
V75 Cargo lashing operations (ro-ro) code no: 631
V76 Safe use of rigging equipment code no: 700
V77 Manual handling techniques code no: 703
V78 Tanker practices series
   Pumping cargo part 1 code no: 501
   Pumping cargo part 2 code no: 502
   Tank cleaning - part 3 code no: 503
   Heating cargo - part 4 code no: 504
   Measuring cargo - part 5 code no: 505
V79 Fighting pollution - preventing pollution at sea (edition 3) code no: 755
V80 Good bunkering practice (edition 2), code no: 962
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V84 Personal safety on chemical tankers, code no: 946 code no: 980
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   Seven steps to ship stability part 2 code no: 623
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| V110 | Safety equipment survey - part 3, code no: 546 |
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| V116 | Oily water separators |
| V117 | Stowaways! A new view on prevention |

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<p>| V118 | SOPEP (CBT # 0004) |
| V119 | ISM Code (CBT # 0005) |
| V120 | Vessel Structural Conditions (CBT # 0014) |
| V121 | Corrosion Protection I (CBT # 0015) |
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| V123 | Steering Gear (CBT # 0017) |
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| V125 | Voyage Planning (CBT # 0026) |
| V126 | Ballast Water Management (CBT # 0027) |
| V127 | Protection and Indemnity (CBT # 0028) |
| V128 | Emergency Towing system (CBT # 0031) |
| V129 | Liquid Cargo Properties (CBT # 0032) |
| V130 | Medical First Aid (CBT # 0036) |
| V131 | Operation of Generators (CBT # 0041) |
| V132 | Bilge Water Separator (CBT # 0043) |
| V133 | Auxiliary Boiler Plant (CBT # 0046) |
| V134 | Radar Observation and Plotting (CBT # 0049) |
| V135 | ARPA Theory (CBT # 0050) |
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Note:
The list of DVDs under the Teaching Aids are for reference only and any other equivalent teaching aids may be prescribed by the Administration.

IMO references (R)
R1  International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1995 (IMO Sales No. 938), and 1997 Amendments to STCW 95 (IMO Sales No. 945) STCW (with Amendments (1 & 4), 2001 Ed. (ISBN Number: 9789280151084 )
R3  Ships’ Routeing (1991-2010, 6-10th edition) (IMO Sales No. 927 ID927E)
R4  Assembly Resolution A.223(VII) - Performance Standards for Radio Direction-Finding Systems ("Revoked by A.665(16)"
R5  Assembly Resolution A.224 (VII) - Performance Standards for Echo-Sounding Equipment
R6  Assembly Resolution A.478 (XII) - Performance Standards for Device to Indicate Speed and Distance ("Amended by A.824(19)", Assembly Resolution A.824(19) - Performance standards for devices to indicate speed and distance
R7  Assembly Resolution A.342 (IX) - Recommendation on Performance Standards for Automatic Pilots
R8  Assembly Resolution A.419 (XI) - World-Wide Navigational Warning Service ("Revoked by A.706(17)"), Assembly Resolution A.706(17) - World-Wide Navigational Warning Service
R11 1994/95 MARPOL Amendments (IMO Sales No. 640)
R12  Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk – Annex II, MARPOL 73/78 (IMO Sales No. 512 86.13.E)
R13  Manual on Oil Pollution, Section I - Prevention (1983 revised edition) (IMO Sales No.557 83.01.E) OUT OF PRINT
R14 Assembly Resolution A.626 (15) - Amendments to the International Regulations for Preventing Collisions at Sea, 1972
R15 Assembly Resolution A.678 (16) - Amendments to the International Regulations for Preventing Collisions at Sea, 1972
R16 Assembly Resolution A.535 (13) - Recommendation on Emergency Towing Requirements for Tankers ("Superseded by MSC.35(63)"
R17 MSC.35(63) - Guidelines for emergency towing arrangements on tankers
R19 IMO Assembly resolution A.474 (XII) – Proper use of VHF channels at sea (“Revoked by A.954(23)”), Assembly Resolution A.954(23) - Proper use of VHF channels at sea
R21 Assembly Resolution A.275 (VIII) - Recommendations on Performance Standards for Mechanical Pilot Hoists (“Revoked by A.889(21)”)
R22 Assembly Resolution A.426 (XI) - Arrangements for Embarking and Disembarking Pilots in Very Large Ships (“Revoked by A.889(21)”)
R23 Assembly Resolution A.601(15) - Provision and Display of Manoeuvring Information on Board Ships (“Refer toA.751(18)”), Assembly Resolution A.751(18) - Interim standards for ship manoeuvrability
R24 Assembly Resolution A.667 (16) - Pilot Transfer Arrangements (“Revoked by A.889(21)”), Assembly Resolution A.889(21) - Pilot transfer arrangements
R25 Assembly Resolution A.529 (13) - Accuracy Standards for Navigation (“Revoked by A.953(23)”), Assembly Resolution A.953(23) - World-wide radio navigation system
R26 Assembly Resolution A.577 (14) - Operational Status of Electronic Position-Fixing Systems
R27 Assembly Resolution A.615 (15) - Radar Beacons and Transponders
R28 Assembly Resolution A.666 (16) - World-Wide Radio Navigation System (“Revoked by A.815(19)” and then from A.815(19) Revoked by resolution A.953(23)”), Assembly Resolution A.953(23) - World-wide radio navigation system
R29 Assembly Resolution A.736 (18) - Amendments to the International Regulations for Preventing Collisions at Sea, 1972
R30 Assembly Resolution A.280 (VIII) - Recommendations on Performance Standards for Gyro-Compasses
R31 Assembly Resolution A.382 (X) - Magnetic Compasses: Carriage and Performance Standards
R32 Assembly Resolution A.384 (X) - Performance Standards for Radar Reflectors
R33 Assembly Resolution A.422 (XI) - Performance Standards for Automatic Radar Plotting Aids (ARPA) (“Amended by A.823(19)”), Assembly Resolution A.823(19) - Performance standards for automatic radar plotting aids (ARPAs)
R34 Assembly Resolution A.424 (XI) - Performance Standards for Gyro-Compasses
R35 Assembly Resolution A.479 (XII) - Performance Standards for Shipborne Receivers for Use with Differential Omega

R36 Assembly Resolution A.526 (13) - Performance Standards for Rate-of-Return Indicators ("Refer to res.A.281(VIII)", Assembly Resolution A.281(VIII) - Recommendation on general requirements for electronic navigational aids

R37 Assembly Resolution A.665 (16) - Performance Standards for Radio Direction-Finding Systems

R38 Assembly Resolution A.694 (17)* - General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids

R39 Assembly Resolution A.380 (X) - Standard Marine Navigational Vocabulary
("Amended by A.488(XII); Revoked by A.918(22)) Assembly Resolution A.918(22) - IMO standard marine communication phrases

R40 Assembly Resolution A.488 (XII) - Use of the Standard Marine Navigational Vocabulary

R41 Assembly Resolution A.429 (XI) - Routeing Systems

R42 Assembly Resolution A.572 (14) - General Provisions on Ships' Routeing ("Amended by MSC.71(69), MSC.165(78)), MSC.71(69) - Amendments to the General Provisions on Ships, MSC.165(78) - Adoption of amendments to the general provisions on ships’ routeing

R43 Assembly Resolution A.528 (13) - Recommendation on Weather Routeing

R44 Assembly Resolution A.113 (V) - Revised International Code of Signals

R45 Assembly Resolution A.187 (VI) - Procedure for Amending and Bringing Up to Date the International Code of Signals


R47 Assembly Resolution A.387 (X) - Procedure for Amending and Bringing Up to Date the Merchant Ship Search and Rescue Manual (MERSAR) ("Revoked by A.894(21)") Assembly Resolution A. 894(21) - International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual

R48 IMO/ILO Document for Guidance, 1985, (IMO Sales No. 935)


Details of distributors of IMO publications that maintain a permanent stock of all IMO publications may be found on the IMO web site at http://www.imo.org

Textbooks (T)


<table>
<thead>
<tr>
<th>T</th>
<th>Title</th>
<th>Author(s)</th>
<th>Publisher/Year and Edition</th>
<th>ISBN Numbers</th>
</tr>
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</table>

I:\STW\44\3-5.doc
Function 2 - Cargo Handling and Stowage at the Operational Level

Teaching facilities and equipment

The following additional equipment is recommended:

- working models of derricks and cranes to illustrate different rigs in handling cargo models or drawings of various types of hatch cover and their operating and securing arrangements
- examples of head and heel cargo blocks
- schematic model of a product tanker, tanks and pump-room, showing piping and valves
- schematic model of a crude carrier, tanks and pump-room, showing piping and valves
- photographs, drawings and plans to illustrate different types of ship
- examples of cargo plans for various types of ship.
- cargo handling and liquid cargo handling simulators are not essential equipment but will greatly enhance trainee learning and the assessment of competence in this function.

**Teaching aids (A)**
A1 Instructor Guidance (Part B of this course)
A2 Video cassette player/DVD Player

**Video cassettes CDs & DVDs**
V1 IMO - Safer shipping and cleaner seas (IMO Code No. VID-202)
V2 Preparing the defence (IMO Code No. VID-301)

Available from: IMO Publications Section
4 Albert Embankment
London SE1 7SR, UK
Fax: +44 20 7587 3241
URL: [www.imo.org](http://www.imo.org)

V3 Chemical tanker operation Part 1 (Code No. 329.1)
V4 Dangerous Goods at Sea Series, Part 1 (Code No. 387)
V5 Dangerous Goods at Sea Series, Part 2 (Code No. 388)
V6 Operation and maintenance of inert gas systems (Code No. 116)
V7 Crude oil washing (Code No. 11)
V8 Reefer container operations (Code No. 481)
V9 Bulk carrier losses (Code No. 532)
V10 Entering into enclosed spaces (Code No. 534)


Available from: IMO Publications Section
4 Albert Embankment
London SE1 7SR, UK
Fax: 44 20 7587 3241
URL: [www.imo.org](http://www.imo.org)

V2 WATCHKEEPING IN PORT Code No: 659
V3 Dangerous Goods at Sea Series (EDITION 5) Code No: 713
V4 Dangerous Goods at Sea Series Part 2 (EDITION 5) Code No: 712
V5 CENTRIFUGAL PUMPS - THEORY & OPERATION Code No: 9
V6 CRUDE OIL WASHING OPERATIONS (EDITION 3) Code No: 707
V7 OPERATION & MAINTENANCE OF INERT GAS SYSTEMS (EDITION 3) Code No: 708
V8 THE SHIP-SHORE INTERFACE (PETROLEUM TANKERS) Code No: 709
V9 SAFE CARGO STOWAGE & SECURING Code No: 747
V10 SHIP TO SHIP TRANSFER - PETROLEUM AND LIQUID CARGOES Code No: 751
V11 TANK PURGING AND LINE CLEANING ONBOARD CHEMICAL TANKERS Code No: 752
V12 INTRODUCTION TO LIQUIFIED GAS CARRIERS (EDITION 2) Code No: 753
V13 SAFE LOG CARRIER OPERATIONS Code No: 760
V14 SUCCESSFUL REEFER CONTAINER OPERATIONS Code No: 788
V15 BULK CARRIERS - HANDLE WITH CARE Code No: 691
V16 HATCH COVERS - A PRACTICAL GUIDE Code No: 938
V17 CHEMICAL TANK CLEANING & INSPECTION (EDITION 2) Code No: 950
V18 CHEMICAL TANKER OPERATIONS: SAFETY AND POLLUTION PREVENTION PART 1 Code No: 951
V19 CHEMICAL TANKER OPERATIONS: SAFETY AND POLLUTION PREVENTION PART 2 Code No: 952
V20 TANK CLEANING PRACTICE Code No: 982
V21 OVER AND UNDER PRESSURISATION OF TANKS (Edition 2) Code No: 984
V21 HANDLING VEGETABLE OILS Code No: 988
V22 DANGEROUS & DIFFICULT BULK CARGOES Code No: 1101
V23 VAPOUR EMISSION CONTROL Code No: 1118
V24 RO-RO SAFETY AND CARGO OPERATIONS Code No: 162
V25 PORTABLE TANKS AND TANK CONTAINERS Code No: 314
V26 REEFER CONTAINER OPERATIONS Code No: 481
V27 FIRE FIGHTING & SAFE CARGO OPERATIONS ON CAR CARRIERS Code No: 540
V28 DON'T GAMBLE WITH SAFETY ON CHEMICAL TANKERS Code No: 595
V29 CARGO LOSS PREVENTION ON BOARD BULK CARRIERS Code No: 598
V30 CARGO LASHING OPERATIONS (RO-RO) Code No: 631
V31 SAFE USE OF RIGGING EQUIPMENT Code No: 700
V32 MANUAL HANDLING TECHNIQUES Code No: 703
V33 Tanker Practices Series
PUMPING CARGO PART 1 Code No: 501
PUMPING CARGO PART 2 Code No: 502
TANK CLEANING - PART 3 Code No: 503
HEATING CARGO - PART 4 Code No: 504
MEASURING CARGO - PART 5 Code No: 505
V34 FIGHTING POLLUTION - PREVENTING POLLUTION AT SEA (EDITION 3) Code No: 755
V35 GOOD BUNKERING PRACTICE (Edition 2), Code No: 962
V36 PERMIT TO WORK Code No: 621
V37 SAFE GANGWAY AND LADDER OPERATIONS, Code No: 946
V38 PERSONAL SAFETY ON TANKERS (EDITION 2), Code No: 970
V39 PERSONAL SAFETY ON CHEMICAL TANKERS, Code No: 946 Code No: 980

Available from:

Videotel Marine International Ltd
84 Newman Street, London W1P 3LD, UK
Note:
The list of DVDs under the Teaching Aids are for reference only and any other equivalent teaching aids may be prescribed by the Administration.

IMO references (R)
R5 Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG) (IMO Sales No. 251)
R9 Assembly Resolution A.288 (VIII) - Recommendation on the Safe Stowage and Securing of Containers on Deck on Vessels Which Are Not Specifically Designed and Fitted for the Purpose of Carrying Containers
R10 Assembly Resolution A.489 (XII) - Safe Stowage and Securing of Cargo Units and Other Entities in Ships Other Than Cellular Container Ships
R12 Assembly Resolution A.533 (13) - Elements to Be Taken Into Account When Considering the Safe Stowage and Securing of Cargo Units and Vehicles in Ships
R13 Assembly Resolution A.581 (14) - Guidelines for Securing Arrangements for the Transport of Road Vehicles on Ro-Ro Ships
R15 1994 and 1995 Amendments to the Code of Safe Practice for Cargo Stowage and Securing (IMO Sales No. 292)

Details of distributors of IMO publications that maintain a permanent stock of all IMO publications may be found on the IMO web site at http://www.imo.org

Textbooks (T)
Function 3: Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level.

Teaching facilities and equipment
The following additional equipment is recommended:
- cut-away three-dimensional models showing the structure of parts of the ship
- photographs, drawings and plans illustrating various types of ship and constructional details
- a floating ship stability demonstration model and a flotation tank. The model should be capable of demonstrating the effects of adding or removing masses, shifting masses, suspending masses and free liquid surface.
- copies of approved stability information books and computer loading programmes from ships
- a marine hydrometer

Teaching aids (A)
A1 Instructor Guidance (Part B of this course)
A2 Video cassette player DVD Player

Video cassettes CDs & DVDs
V1 IMO - Safer shipping and cleaner seas (IMO Code No. VID-202)
V2 Preparing the defence (IMO Code No. VID-301)

Available from: IMO Publications Section
4 Albert Embankment
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<tr>
<td>623</td>
<td>SEVEN STEPS TO SHIP STABILITY PART 2</td>
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<tr>
<td>682</td>
<td>ENTERING INTO ENCLOSED SPACES (EDITION 2)</td>
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<tr>
<td>621</td>
<td>PERMIT TO WORK</td>
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<tr>
<td>701</td>
<td>SAFE HOT WORK PROCEDURES</td>
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<td>627</td>
<td>WASTE AND GARBAGE MANAGEMENT</td>
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<td>FIGHTING POLLUTION - PREVENTING POLLUTION AT SEA (EDITION 3)</td>
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<td>550</td>
<td>HULL STRESS MONITORING</td>
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<td>BASIC FIRE FIGHTING (EDITION 3)</td>
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<td>HELICOPTER OPERATIONS AT SEA (EDITION 2)</td>
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<td>STCW AND FLAG STATE IMPLEMENTATION</td>
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<td>935</td>
<td>SEARCH TECHNIQUES</td>
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<td>484</td>
<td>SECURITY AT SEA</td>
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<td>947</td>
<td>IMMERSION SUITS - THE DIFFERENCE BETWEEN LIFE AND DEATH</td>
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<td>MUSTER LISTS, DRILLS &amp; HELICOPTER OPERATIONS</td>
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<td>974</td>
<td>SHIPSHAPE. A GUIDE TO GOOD HOUSEKEEPING PART 1: ON DECK</td>
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<td>947</td>
<td>THE SHIPBOARD MANAGEMENT ROLE (EDITION 2)</td>
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<td>969</td>
<td>PORT STATE CONTROL - TIGHTENING THE NET (Edition 2)</td>
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<tr>
<td>510</td>
<td>HEALTH &amp; WELFARE ADVICE FOR SEAFARERS</td>
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<td>993</td>
<td>PERSONAL HYGIENE</td>
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V24 MEDICAL FIRST AID (Edition 2), Code No: 990
V25 ENCLOSED LIFEBOATS, FREÉFALL LIFEBOATS RESCUE BOATS, Code No: 679
V26 LOAD LINE SURVEYS - PART 1, Code No: 544
V27 SAFETY CONSTRUCTION SURVEY - PART 2, Code No: 545
V28 SAFETY EQUIPMENT SURVEY - PART 3, Code No: 546

Available from: Videotel Marine International Ltd
84 Newman Street, London W1 P 3LD, UK
Tel: +44 20 72991800 Fax: +442072991818
e-mail: mail@videotelmail.com
URL: www.videotel.co.uk

Note:
The list of DVDs under the Teaching Aids is for reference only and any other equivalent teaching aids may be prescribed by the Administration.

IMO references (R)
R6 Regulations for The Control of Pollution by Noxious Liquid Substances in Bulk
Annex II, MARPOL 73/78 (IMO Sales No. 512)
R7 Manual on Oil Pollution, Section I - Prevention (1983 revised edition), (IMO Sales No. 557)
Manual on Oil Pollution - Section II – Contingency Planning, 1995 Edition
Manual on Oil Pollution - Section III - Salvage, 1997 Edition
IMO Sales No. IA566E ISBN 978-92-801-14423
Manual on Oil Pollution - Section IV – Combating Oil spills, 2005 Edition
IMO Sales No. IA569E ISBN 978-92-801-41771

Manual on Oil Pollution - Section VI - IMO Guidelines for Sampling and Identification of Oil Spills, 1998 Edition
IMO Sales No. IS78E ISBN 978-92-801-14515

MANUAL ON CHEMICAL POLLUTION - Section 1 – Problem Assessment and Response Arrangements (1999 Edition)
IMO Sales No. IA630E ISBN 978-92-801-60963

MANUAL ON CHEMICAL POLLUTION - Section 2 – Search and Recovery of Packaged Goods Lost at Sea (2007 Edition)

  - Geneva Convention of the Territorial Sea and the Contiguous Zone, 1958
  - Geneva Convention on the Continental Shelf, 1958


R10 IMO Assembly Resolution A.671 (16) - Safety Zones and Safety of Navigation Around Offshore Installations and Structures

R11 Supplement relating to the International Convention on Load Lines, 1966 (IMO Sales No. 705)

R12 IMO Assembly Resolution A.513(13) - Amendments to the International Convention on Load Lines, 1966

R13 IMO Assembly Resolution A.603(15) - Symbols Related to Life-Saving Appliances and Arrangements
IMO Assembly Resolution A.760(18) 1993. Symbols related to life-saving appliances and arrangements

R14 IMO Assembly Resolution A.624 (15) - Guidelines on Training for the Purpose of Launching Lifeboats and Rescue Boats From Ships Making Headway Through the Water, IMO Assembly Resolution A.921(22) 2001. Assembly resolutions superseded by the 1995 amendments to the 1978 STCW Convention


R24 IMO Assembly Resolution A.494 (XII) - Revised Interim Scheme for Tonnage Measurement for Certain Ships

R25 IMO Assembly Resolution A.540 (13) - Tonnage Measurement for Certain Ships Relevant to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978


R27 IMO Assembly Resolution A.769(18) - Procedures and Arrangements for Issuing GMDSS Certificates to Holders of Non-GMDSS Certificates

R28 IMO/ILO Document for Guidance, 1985, (IMO Sales No. 935)


R33 GRAPHICAL SYMBOLS FOR FIRE CONTROL PLANS (2006 Edition)

IMO Sales No. IA847E ISBN 978-92-801-42259


R35 PREVENTION OF CORROSION ON BOARD SHIPS (2010 Edition)

R36 IMO Assembly Resolution A.1001(25) 2007. Criteria for the provision of mobile satellite communication systems in the global maritime distress and safety system (GMDSS)


R39 MSC.306(87) 2010. Revised performance standards for enhanced group call (EGC) equipment

R40 IMO/UNEP GUIDELINES ON OIL SPILL DISPERASANT APPLICATION INCLUDING ENVIRONMENTAL CONSIDERATIONS (1995 Edition)
IMO Sales No. IA575E ISBN 978-92-801-13327

R41 MANUAL ON OIL SPILL RISK EVALUATION AND ASSESSMENT OF RESPONSE PREPAREDNESS (2010 Edition)

R42 GUIDELINES FOR THE DEVELOPMENT OF SHIPBOARD MARINE POLLUTION EMERGENCY PLANS (2010 Edition)

R43 PROCEDURES FOR PORT STATE CONTROL (2000 Edition)


Details of distributors of IMO publications that maintain a permanent stock of all IMO publications may be found on the IMO web site at http://www.imo.org

Textbooks (T)


Note: The list of text books or reference books are for guidance purpose only and the text books / reference material from the local or other authors may be prescribed by the Administration
Function 1:

Navigation at the Operational Level
Function 1: Navigation at the Operational Level

Part B1: Course Outline

Timetable
No formal example of a timetable is included in this model course.

Development of a detailed timetable depends on the level of skills of the trainees entering the course and the amount of revision work of basic principles that may be required.

Lecturers must develop their own timetable depending on:

- the level of skills of trainees
- the numbers to be trained
- the number of instructors

and normal practices at the training establishment.

Preparation and planning constitute an important factor which makes a major contribution to the effective presentation of any course of instruction.

Lectures
As far as possible, lectures should be presented within a familiar context and should make use of practical examples. They should be well illustrated with diagrams, photographs and charts where appropriate, and be related to matter learned during seagoing time.

An effective manner of presentation is to develop a technique of giving information and then reinforcing it. For example, first tell the trainees briefly what you are going to present to them; then cover the topic in detail; and, finally, summarise what you have told them. The use of an overhead projector and the distribution of copies of the transparencies as trainees handouts contribute to the learning process.

Course Outline
The tables that follow list the competencies and areas of knowledge, understanding and proficiency, together with the estimated total hours required for lectures and practical exercises. Teaching staff should note that timings are suggestions only and should be adapted to suit individual groups of trainees depending on their experience, ability, equipment and staff available for training.
### COURSE OUTLINE

**Competence:**

1. **PLAN AND CONDUCT A PASSAGE AND DETERMINE POSITION**

#### 1.1.1 CELESTIAL NAVIGATION

<table>
<thead>
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<th>Section</th>
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<tr>
<td>.1</td>
<td>Solar system</td>
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<tr>
<td>.2</td>
<td>Celestial sphere and equinoctial system of co-ordinates</td>
<td>4</td>
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<tr>
<td>.3</td>
<td>Hour angle</td>
<td>4</td>
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<tr>
<td>.4</td>
<td>Daily motion and horizontal system of co-ordinates</td>
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<tr>
<td>.5</td>
<td>Sextant and altitude corrections</td>
<td>6</td>
</tr>
<tr>
<td>.6</td>
<td>Amplitude</td>
<td>2</td>
</tr>
<tr>
<td>.7</td>
<td>Time and equation of time</td>
<td>2</td>
</tr>
<tr>
<td>.8</td>
<td>Nautical Almanac</td>
<td>6</td>
</tr>
<tr>
<td>.9</td>
<td>Latitude by meridian altitude</td>
<td>3</td>
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<tr>
<td>.10</td>
<td>Pole Star observations</td>
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#### 1.1.2 TERRESTRIAL AND COASTAL NAVIGATION

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<td>.5</td>
<td>Distances</td>
<td>3</td>
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<tr>
<td>.6</td>
<td>Position lines and positions</td>
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<tr>
<td>.7</td>
<td>Sailings</td>
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<tr>
<td>.8</td>
<td>Chartwork exercises</td>
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<td>.9</td>
<td>Information from charts, lists of lights and other publications</td>
<td>44</td>
</tr>
<tr>
<td>.10</td>
<td>IALA Buoyage System</td>
<td>2</td>
</tr>
<tr>
<td>.11</td>
<td>Tides</td>
<td>18</td>
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<tr>
<td>.12</td>
<td>Keeping a log</td>
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#### 1.1.3 ELECTRONIC SYSTEMS OF POSITION FIXING AND NAVIGATION

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<td>Basic principles of hyperbolic navigation systems</td>
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<tr>
<td>.2</td>
<td>Loran-C system</td>
<td>3</td>
</tr>
<tr>
<td>.3</td>
<td>eLoran</td>
<td>2</td>
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<td>.4</td>
<td>Global navigation satellite systems</td>
<td>10</td>
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<td>.5</td>
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#### 1.1.4 ECHO-SOUNDERS AND SPEED MEASUREMENT

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Teaching staff should note that the hours for lectures and exercises are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adapted by lecturers to suit individual groups of trainees depending on their experience, ability, equipment and staff available for teaching.
1.1.5 COMPASS – MAGNETIC AND GYRO

.1 The magnetism of the earth and the ship’s deviation
.2 The magnetic compass
.3 The gyro-compass
.4 Compass corrections
.5 Errors of the compass and azimuths
.6 Fluxgate compass

1.1.6 STEERING AND CONTROL SYSTEM

.1 The automatic pilot

1.1.7 METEOROLOGY

.1 Shipborne meteorological instruments
.2 The atmosphere, its composition and Physical properties
.3 Atmospheric pressure
.4 Wind
.5 Cloud and precipitation
.6 Visibility
.7 The wind and pressure systems over the ocean
.8 Structure of depressions
.9 Anticyclones and other pressure systems
.10 Weather services for shipping
.11 Recording and reporting weather observations
.12 Weather forecasting

2. MAINTAIN A SAFE NAVIGATIONAL WATCH

2.2.1 KNOWLEDGE OF THE COLLISION REGULATIONS

.1 Content, application and intent of COLREG ’72

2.2.2 PRINCIPLES IN KEEPING A NAVIGATIONAL WATCH

.1 Principles to be observed in keeping a navigational watch
.2 Keeping a watch in port

2.2.3 BRIDGE RESOURCE MANAGEMENT

.1 Bridge Resource Management

2.2.4 THE USE OF ROUTEING

.1 Weather routing
.2 Use of routeing in accordance with general provisions on ships' routeing

Teaching staff should note that the hours for lectures and exercises are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adapted by lecturers to suit individual groups of trainees depending on their experience, ability, equipment and staff available for teaching.
1.3 USE OF RADAR AND ARPA TO MAINTAIN SAFETY OF NAVIGATION

See IMO Model Course No. 1.07 and STCW 1995 Regulation 1/12

1.4 USE OF ECDIS TO MAINTAIN SAFETY OF NAVIGATION

See IMO Model Course No. 1.27

1.5 1.4 RESPOND TO EMERGENCIES

1.5.1 1.4.1 PRECAUTIONS FOR PROTECTION AND SAFETY OF PASSENGERS

.1 Contingency plans for response to emergencies
.2 Precautions for protection and safety of passengers in emergency situations

1.5.2 1.4.2 INITIAL ACTION FOLLOWING COLLISION OR GROUNDING

.1 Precautions when beaching a vessel
.2 Actions on stranding/grounding
.3 Actions following a collision
.4 Means of limiting damage and salvaging ship following fire or explosion
.5 Procedures for abandoning ship
.6 Use of auxiliary steering gear and rigging jury steering arrangements
.7 Arrangements for towing and being towed

1.5.3 1.4.3 RESCUING PERSONS FROM THE SEA, ASSISTING A SHIP IN DISTRESS AND PORT EMERGENCIES

.1 Rescue of persons from a vessel in distress
.2 Actions for emergencies in port
.3 Measures for assisting a vessel in distress

1.6 1.5 RESPOND TO A DISTRESS SIGNAL AT SEA

1.6.1 1.5.1 SEARCH AND RESCUE

.1 MERSAR IAMSAR

1.7 1.6 ENGLISH LANGUAGE

See IMO Model Course 3.17

1.7.1 1.6.1 ENGLISH LANGUAGE

1.7.2 1.6.2 USE THE STANDARD MARINE NAVIGATIONAL VOCABULARY

IMO STANDARD MARINE COMMUNICATION PHRASES

Teaching staff should note that the hours for lectures and exercises are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adapted by lecturers to suit individual groups of trainees depending on their experience, ability, equipment and staff available for teaching.
### 1.8 1.7 TRANSMIT AND RECEIVE INFORMATION BY VISUAL SIGNALLING

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### 1.9 1.8 MANOEUVRE THE SHIP

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**Total for Function 1: Navigation at the Operational level** 632

Teaching staff should note that the hours for lectures and exercises are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adapted by lecturers to suit individual groups of trainees depending on their experience, ability, equipment and staff available for teaching.
Guidance Notes

The following notes are intended to highlight the main objectives or training outcomes of each part of the function. The notes also contain some material on topics which are not adequately covered in the quoted references.

This function covers the theory and practice of navigation necessary for the effective and safe navigation of the ship in coastal waters, including the use of charts, position fixing by terrestrial observations and the extraction of information from relevant documents. The use of electronic navigational aids is covered but proficiency in the use of radar forms the subject of a separate model course. It also deals with the theory and practice of the use of observations of celestial bodies for determining position lines and checking compass errors.

Trainees will gain a thorough knowledge of COLREG 1972 and be able to apply them when in charge of a navigational watch. They will be capable of keeping a safe and effective watch, both at sea and in port, taking into account the principles in the STCW Code Section A-VIII.

Function 1: Navigation at the Operational Level

On completion trainees will possess a knowledge of the basic theory of magnetism and magnetic compasses. They will also know the basic theory of gyro compasses. Trainees will be familiar with the practical use of magnetic and gyro compasses and automatic pilots, their routine maintenance and the limitations of the instruments. Emphasis is placed on a knowledge of instrument errors, adjustments, the importance of frequent checking and the ways of doing it.

Trainees will be aware of the need to make themselves familiar with contingency plans and their immediate duties in the event of an emergency arising. They will also know the procedures to be followed for the safety of life and the ship in various emergencies and the actions which will be expected from them as junior officers at operational level in response to those situations. Their knowledge of emergency procedures will also enable them to take charge of those parts of the operation for which they are responsible.

Trainees will have sufficient knowledge of the Morse code and correct procedures to enable them to transmit and receive messages, the distress signal ‘SOS’ by Morse light. They will know the flags of the International Code of Signals (R17) and know the significance of the single letter signals and how to make use of that publication.

Sufficient understanding of meteorology is covered for watchkeepers to be able to apply it for the safe operation of the ship. This includes a knowledge of shipborne meteorological instruments and their application, knowledge of the characteristics of weather systems, reporting procedures and recording systems and the ability to apply the met information available. In addition, the knowledge gained in this subject will serve as the basis for further training to the level of chief mate and master.
Trainees will be familiar with the manoeuvring information available on board ship with particular reference to turning circles and stopping distance and how they are affected by shallow water and the draught and trim of the ship. They will know the procedures and actions to take and the manoeuvres required for the rescue of a man overboard.

1.1 Plan and Conduct a Passage and Determine a Position

1.1.1 CELESTIAL NAVIGATION

Solar system
The trainee should possess a general and basic knowledge of the solar system, the earth's orbit and rotation around its axis, and how these motions lead to the phenomena of seasons and day and night. The distinction between inferior and superior planets may be explained but it is more important that the students can identify the planets that are of use for navigation.

Celestial sphere and equinoctial system of co-ordinates
Precise definitions are necessary. Extensive use of figures is very helpful. Prepared transparencies can be used, but it is considered better to draw one's own during a lecture because trainees can follow the construction and are motivated to draw their own figures.

Hour angle
The trainee should be set exercises as soon as possible. To promote a thorough understanding, the initial exercises should be illustrated by figures.

Daily motion and horizontal system of co-ordinates
This subject area represents the theoretical approach to position computations, with a celestial body on and off the meridian. It is important to deal with the theoretical background for the computations in steps. One possible way is to compute latitude by using first the sun and then Polaris. Next, one may treat the PZX triangle with a celestial body off the meridian and compute the altitude and direction of the position line.

Sextant and altitude corrections
The trainee should first practise measuring the altitude of the sun, reading a sextant and applying index error. Secondly, the trainee should do exercises in correcting a sextant. Regarding altitude corrections, it is optional whether the Nautical Almanac or an appropriate nautical table is used. It is recommended that the trainee does sufficient simple exercises in altitude corrections to master such problems thoroughly.

At low altitudes the correction for refraction is significant. The trainee should understand this effect and be able to explain it.
Amplitude
This subject area forms the theoretical approach to calculating compass error by means of celestial bodies.

Time and equation of time
The trainee should have a basic understanding of the concept of time, with emphasis on practical time problems. Time is not treated in textbook T13; an abstract from T14 may be used.

Nautical Almanac
The Nautical Almanac contains much information absolutely essential to the watchkeeping officer. The different parts of this subject area should be taught in connection with those subject areas where the information from the Nautical Almanac is necessary. A Nautical Almanac must be available to each trainee. The almanacs need not be of the latest issue, but the same issue should be used by all members of the class.

Latitude by meridian altitude
Time of meridian passage is not covered in textbook T13. As a text for this part, an abstract from T14 may be used. The method used to calculate time of meridian passage is optional. The method starting from local hour angle being zero may be preferable because the procedure is the same for all bodies.

The determination of the latitude by meridian altitude is, because of its simplicity, widely used, and the noon observation of the sun is a daily occurrence on a ship at sea.

Pole Star observations
Reference will be made, to the fact that the altitude of the celestial pole is equal to the latitude of the observer. Because Polaris is so close to the celestial pole, the star describes a small circle with an angular radius of less than 1°, and the latitude of the observer can be derived by making small adjustments to the altitude.

Position fixing
The theoretical approach to position fixing using astronomical position lines could be treated a part at a time, in parallel with the position calculations on which the trainees are working.

To compute the altitude of the celestial body, three methods are available:

- the cosine formula and a pocket calculator
- the haversine formula and logarithmic tables
- pre-computed altitude and azimuth tables.

Which of these should be chosen is optional. After having introduced these methods, it is recommended to select one of them and specialize on that particular method. These days, with easy access to inexpensive pocket calculators, the first method may be preferable.
The Marcq St. Hilaire method of position fixing is universal and can be utilized for any celestial body in any direction, the body in the meridian included. It is recommended that position fixing using celestial bodies out of the meridian is restricted to this method.

The importance of doing exercises in altitude computations and position fixing by combining position lines cannot be overestimated.

Fixing positions should be carried out as geometrical problems preferably on an ocean plotting sheet or the navigation chart used (if scale permits).

1.1.2 TERRESTRIAL NAVIGATION

Definitions - Earth
The main object of this section is to give the trainee a basic knowledge of the shape of the earth, its co-ordinate systems and units of distance measurement. The section gives the theoretical background for dead-reckoning sailing.

Charts
The trainee should have a basic and practical knowledge of how the spheroid is projected on to a plane chart. The trainee is to have knowledge of other types of projection. The use of charts of appropriate scale for various purposes is very important and should be stressed. It is also important to have charts of the latest issue or latest update. The trainee should therefore be familiar with the procedures for correction of charts and publications including chart catalogues and Notices to Mariners, worldwide and national, and the use of these publications in ensuring the charts are updated accordingly with T&P notices and using information from Notices to Mariners.

ECDIS
The advent of Electronic Chart Display and Information Systems (ECDIS) and other electronic chart systems for the maritime industry was recognized at the time of the revision of STCW. Reference to 'ECDIS systems' is included in Table A-I/1 of the STCW Code. Performance standards for electronic chart systems have been adopted by IMO. Resolution A.817 provides that compliant systems fulfill the requirements of SOLAS V/20 for the carriage of charts. Trainees should undertake the training contained in the revised IMO model course 1.27 in relation to electronic charts.

Familiarisation with a particular ship's electronic chart equipment, its controls, facilities and characteristics, will usually be achieved through onboard training, reference to the operator's manual, or by means of training courses. It is important that trainees understand that this familiarisation training is essential in being able to apply the knowledge and skills from the generic model course to the equipment on board any vessel they serve.
Datums
The intention is to define different systems for measuring and computing, define the origin and direction of the co-ordinate system and the units of measurement. The origin of the co-ordinate system on the earth's surface is the crossing between the equator and the Greenwich meridian; the units are degrees and minutes of arc. The origin of direction depends upon whether direction is measured by magnetic compass or by gyro. Relations between these directions and calculations are dealt with in required performance 1.1.5.4

Distances
The trainee should be familiar with the origin of the nautical mile and be well practiced in measuring distances on a Mercator chart. In measuring distance off from the chart, the trainee must know the limitations of the Mercator Chart projection so as to ensure the accuracy of the measurement.

Position lines and positions
The trainee should have a basic knowledge of geometry prior to starting on position-line problems. It is important to have a thorough understanding of the idea of position lines. The trainee must learn that the geometric principle of combining position lines is the same irrespective of which kind of position line is used. It would not be educationally sound to use too many types of combinations to begin with.

Sailings
The plane sailing formula has sufficient preciseness for distance within a 24-hour period. It is optional whether traverse tables or a calculator is used. These days, with low-priced calculators, the latter is recommended. Once the computing method has been chosen, it is recommended to continue practicing, using that method. It is important to stress the importance of a well-arranged layout for the sailing computations. This subject area requires previous knowledge of trigonometry. Exercises of this kind could well be treated in the subject of mathematics.

The ability to determine courses and distances by Mercator sailing for rhumb line passages of greater distance is important for operational level officers of the watch to support voyage planning and conduct.

At this level, only basic knowledge and the ability to find the initial course and distance by calculation is required in the area of great-circle sailing. Trainees should be able to plan great circle sailings using gnomonic charts and the transfer of positions to mercator charts

In addition to computing sailing problems, the trainee must practice sailings on charts and ocean plotting sheets.

Chartwork exercises
When doing chartwork exercises, it is recommended to bring in one problem at a time in the starting phase. When the trainee has gained more experience, the exercises may gradually be made more complex.

In the classroom, each trainee should work on his/her own chart. Group activity is, however, recommended; for instance, in such a way that two trainees have their
desks put together and work individually, but on the same exercise and with the opportunity to discuss problems as the work is going on. Textbooks, manuals, sailing directions, etc. should be available. Individual attention can be given by the instructor to trainees who need assistance.

More complex exercises (sailings) may be carried out on a training vessel and/or bridge simulator, if available.

Information from charts, lists of lights and other publications
This subject area is primarily concerned with reading information from charts and appraising information from nautical publications. It is essential for a nautical officer to understand fully the signs and symbols on charts, with special emphasis on buoys and beacons. Thus, the trainee should be familiar with the IALA Maritime Buoyage System for all regions.

It takes some time to become familiar with a chart, its huge amount of information, use and limitations. Therefore, it is important to give the trainees time for chart exercises, including, if possible some aboard a training vessel.

Tides
The variation of water level can be interpreted as made up of two components, the astronomical component (tide) and the meteorological component. The tide is predicted to a reasonable accuracy for different ports around the world. The meteorological component cannot be predicted, at least not for longer periods than normal weather prediction. This latter component is added to or subtracted from the predicted height. It is therefore important to emphasize that the predicted height of seawater is not an accurate value and trainees are advised to keep in mind the requirement of specific under-keel clearance.

Keeping a Log
Various log-books and voyage records need to be kept on a ship. Under some flags keeping a log is regulated by laws, in others it is a matter of custom. The intention of this subject area is first to draw attention to national and international law and practice, and secondly to provide the trainee with a certain amount of practice in the complete and proper keeping of log-books and other voyage records. Reference to the company’s ISM Safety Management System is to be made on the types and information to be logged in the log-books.

1.1.3 ELECTRONIC SYSTEMS OF POSITION FIXING AND NAVIGATION

Basic principles of hyperbolic navigation
This subject area is an introduction to the general theory of hyperbolic position lines. The topic should not be given a mathematical approach, but a basic understanding of the nature of hyperbolic position lines is important. Graphic representation should be used.
Demonstration should be given of how the position lines diverge as distance from the foci (stations) increases, how intersection between position lines varies and how these facts influence the accuracy.

**Loran-C system**
The main points in this subject area should be the practical use of the instrument, position fixing using Loran-C, coverage area, possible errors and accuracy. The trainee should be able to explain how various external factors may effect accuracy of position data.

**Satellite navigation systems**
*Global navigation satellite system*

GPS (Navstar) is the primary satellite system, although reference should be made to GLONASS, GALLILEO and other systems.

The principles of Pseudo Range and Differential GPS should be discussed.

Reference should be made to types of errors due to the system and those which may be caused by the use of different datums in the system and the chart in use. The trainee should be reminded that a position obtained from GPS is not the sole source of information and, if available, clearly identifiable terrestrial landed objects should be the main priority as sources of position fixing reference.

**1.1.4 ECHO-SOUNDERS AND SPEED MEASUREMENT**

**Echo-sounders**
Again, practical use, operation and handling should form the main part of the training programme. The importance of the echo-sounder as a navigational aid for safe navigation should not be underestimated. The trainee must also be aware of the instrument limitation and accuracy when using this tool.

**Speed logs**
Various types of logs and how they function, their accuracy and how they are calibrated and treated.

**1.1.5 COMPASS – MAGNETIC AND GYRO**

**The magnetism of the earth and the ship's deviation**
Trainees should be familiar with the basic theory of the earth's magnetism, the ship's magnetism and conditions that lead to errors in the indication of heading. From that knowledge they will realize that the procedures for frequent checking of compasses are important.

**The magnetic compass**
Trainees should undertake practical exercises in the use of compasses for normal day-to-day watchkeeping. Emphasis should be placed on the limitations of the instrument and the need for regular and frequent checking of the compass error.

The intention in this objective is that the trainee should be able to deal descriptively with the deviation produced on various headings by a magnet or soft iron rod in a
given position, relative to the compass, in an otherwise non-magnetic vessel. This should be used to draw attention to the dependence of deviation upon heading and to emphasize the importance of determining the deviation immediately after any large alteration of course. Trainees should not be expected to deal with the P, Q, R fields or the soft iron rods.

The gyro-compass
The importance of regular and frequent checking of the gyrocompass against magnetic compasses, of repeaters against the master gyro and of gyro-compass error should be emphasized.

The IMO/ILO Document for Guidance, 1985, (R48) recommends that courses should be conducted by the makers of each type of gyro-compass and, if possible, that deck officers should attend the course appropriate to the gyro-compass they will use, although the general theory and use of gyro-compasses will have been covered in their certificate examination.

Use of a particular make and model will be necessary in order to show how support, control, damping and heading indication are achieved in a practical gyro-compass and to provide trainees with experience in operating a compass. The manufacturer's handbook and maintenance instructions for the compass used should be available.

Compass corrections
Compass correction is basic knowledge for a watchkeeping officer. It is very important that the officer understands and can apply such corrections. The trainee should be given numerous exercises on this. In addition to classroom exercises, training in compass correcting as a cadet or on a training vessel would be very useful. The training should be as close to practical watchkeeping duties as possible, taking magnetic variations from charts and deviations from a table of deviations. In addition, the trainee should be trained in finding gyro error and compass deviation by talking bearings and making calculations.

Errors of compasses - Azimuths
The compass can be checked by transit bearing, bearing to a distant object or azimuth of a celestial body. Checking by means of the amplitude method is the simplest and therefore the most common way of compass checking using celestial bodies. The comparison of compasses, for instance of gyro-compass against magnetic compasses, should be a normal checking procedure. The importance of frequent checks should be stressed. It is important to emphasise that compass error should be obtained at every watch and at every large alteration of course.

1.1.6 STEERING AND CONTROL SYSTEMS 6 hours

The automatic pilot
Different procedures for change-over from automatic to manual steering, and vice versa, are required with different types of equipment and the trainees should be aware of the importance of early familiarization with such procedures on first meeting the equipment
The instructor should explain that mandatory requirements concerning the use of autopilot and manual steering are given in Section A-VIII/2 Part 3-1 paragraphs 34 and 35.

1.1.7 METEOROLOGY 79 hours

Shipborne meteorological instruments
Normal shipborne instruments should be available for training purposes. It is a good idea to arrange for trainees, individually or in groups, to make regular observations and keep a weather log during the training period. Details of instruments are contained in the Marine Observer's Handbook (T47).

The atmosphere, its composition and physical properties
The trainee should have a basic knowledge of the structure of the atmosphere and its properties so as to be able to understand the weather systems. The distribution of water vapour and its behaviour in the atmosphere are particularly important.

Atmospheric pressure
Keeping a log of barometer readings or barograph records will provide trainees with a practical approach to the understanding of weather systems. Diurnal variation and pressure changes during the passage of depressions can be observed.

Wind
Reading instruments and logging observations provides valuable practice. As part of their training, trainees should estimate the wind force according to the Beaufort scale from observations of the sea state where possible. They should be encouraged to relate the observed winds to the isobars on the surface synoptic charts for the area, where these are available.

Trainees should be able to find the true wind, given the ship's course and speed and the apparent wind as parameters. They should also be aware that readings from a ship's anemometer may be distorted considerably by the effects of the ship's structure movement.

Cloud and precipitation
No single observation tells more about the weather than cloud formations. Observation of clouds is both important and difficult. Trainees should make use of the WMO Cloud Sheet (A2) for identification of cloud types. Photographs of cloud types can also be found in the Marine Observer's Handbook (T47).

Visibility
It should be stressed that estimation for visibility is very important for the purposes of safe navigation. Trainees should be reminded that the radar range at which objects or lights are first sighted can give a good estimation of visibility, particularly at night.

The wind and pressure systems over the oceans
The trainee should have a basic knowledge of the general global relationship between pressure distribution and wind circulation, including the doldrums, trade winds, monsoon areas and seasons, winds of the temperate zone and the more
important local winds. There are good world climatic charts in The Mariner's Handbook (T61) in addition to those in the textbooks.

**Structure of Depressions**

Observations and recordings of weather made by the trainees should be used to reinforce the theory. It is particularly helpful to relate the weather experienced to the synoptic charts of the system producing it.

**Waves**

The mechanics of wave generation should be understood together with the factors of duration of generating wind, fetch, and lee and weather shores.

**Weather services for shipping**

Details of radio weather services are contained in the Admiralty List of Radio Signals, volume 3. Forecast areas and weather reporting areas are contained in NP 283(a), (A20) and diagrams relating to Weather Reporting and Forecast Areas.

During the period of the course, the trainee should receive a number of radio weather bulletins which are also available via Navtex and, if the equipment is available, synoptic charts by facsimile.

**Recording and reporting weather observations**

Trainees should practice coding observations into the form required for transmission by radio. They should also be able to decode station reports and plot the information on a weather map in standard form. The Ship's Code and Decode Book (A36) contains the international codes and procedures. Trainees should not be expected to memorize the codes.

**Weather forecasting**

On occasions, the observations taken do not agree with the forecasts or prognostic charts as the result of a system having a speed or direction of movement different from that expected. Trainees should be able to use their observations and knowledge of the weather expected in different parts of the system to revise the original forecast.

Trainees should recognise the term Tropical Revolving Storm (TRS) as an intense depression which is a potential threat to safety of navigation and one needing to be avoided. A full treatment of TRS is covered at the management level.

1.2 **Maintain a Safe Navigational Watch**

**The content, application and intent of COLREG 72**

A large proportion of the time allocated to this subject will be used for training in the recognition of lights and shapes, using rule-of-the-road models or magnetic boards. Trainees should be able to recognize the type of vessel, aspect and any special significance of the signals and, given that the compass bearing is not appreciably changing, state what action they would take, if any, and what signals should be made. They should also be able to state the lights or shapes to be displayed by
various types of vessel in any circumstances and describe fully the characteristics of the lights. Question-and-answer sessions should include the use of sound signals and actions to take in fog, bearing in mind that the use of radar for collision avoidance is also dealt with in simulator-based training.

It is important that trainees at this level recognize circumstances in which they should call the master and some situations should be presented to them in which calling the master is one of the proper actions to take. It should be impressed upon them that until such time as the master formally takes over from them they remain in charge of the watch and should continue to take all actions necessary for the safety of the ship.

Attention should be drawn to regulations referring to navigation with a pilot embarked. The presence of a pilot on board does not relieve the officer in charge of the watch from his duties and obligations for the safety of the ship. Responsibility for the watch can only be handed over to the master or to another of the ship's watchkeeping officers and on no account should the pilot be left alone on the bridge.

**A Guide to the Collision Avoidance Rules** provides accounts of collisions together with court judgements, which should be used as appropriate to illustrate how the various rules should be applied. They are particularly useful when dealing with subjective concepts such as 'proper look-out', 'full appraisal', 'safe speed' and 'positive action in ample time'.

**Keeping a safe navigational watch**
This should be based on the requirements set out in the appropriate regulations and recommendations, see R1, Section A-VII 1/1 and VII 1/2 of the STCW Code.

The book 'Strandings and their Causes' provides details of strandings which became the subject of official investigations. In most cases, a failure to keep an adequate navigational watch caused or contributed to the accident. These, and cases described in ref. T6 where collision resulted partly from the same cause, should be used to emphasize the importance of following the guidance given. Particular attention should be drawn to the recommendation to fix the ship's position by more than one method whenever possible. The tendency to rely entirely on radar fixes in coastal waters should be discouraged.

1.1.2 **PRINCIPLES IN KEEPING A NAVIGATIONAL WATCH**

10 hours

**Principles to be observed in keeping a navigational watch**

**Keeping a Watch in Port**

**Keeping an effective deck watch in port under normal circumstances**
In addition to the recommendations in the most recent resolutions, see R1, Section A-VIII/2 Part 4 of the STCW Code, the instructor should deal with national rules or regulations concerning such things as the rigging and lighting of gangways, fencing of openings, provision of safe walkways on deck, safety of cargo operations, the normal work of the deck crew and supervision of repair work regarding the safety of the ship. Guidance on safe working practices should be given. Reference should also be made to any national code of safe working practice concerning a deck officer's
Keeping a safe deck watch in port when carrying hazardous cargo
Particulars of safety measures required in oil, chemical and liquefied gas tankers are dealt with in specialized courses required to be taken by those serving in such ships. This section should deal with those precautions which are common to many hazardous cargoes of differing types. Trainees should know how to establish whether a given cargo is hazardous and where to find details of the hazard it presents and any special precautions for its safe handling and carriage. Typical precautions which may be required include: prohibition of smoking and use of naked lights, ensuring that specified means of fire extinguishing are ready for immediate use, restriction of access to the ship to authorized persons, ensuring that special absorbents are available for dealing with small spills, special first-aid requirements, protective clothing, prohibiting the use of radio or radar transmitters, keeping main engines ready for use at short notice and establishing special signals or communications for alerting shore authorities in the event of an emergency.

A description of the 'permit to work' system for controlling potentially hazardous tasks, in particular for entry into enclosed spaces, should be included (T70)

Note that Section A-VIII/2 Part 4-5 of the STCW Code covers mandatory requirements for watch in port on ships carrying hazardous cargoes.

1.2.3 EFFECTIVE BRIDGE TEAMWORK PROCEDURES ———— 8 hours

1.2.3 BRIDGE RESOURCE MANAGEMENT ———— (8 hours)

Bridge teamwork procedures Bridge Resource Management
All ship's personnel who have bridge navigational watch duties are part of the bridge team. The master and pilot, as necessary, will support the team, which comprises the watchkeeping officer, helmsman and lookout.

The watchkeeping officer is in charge of the bridge and the bridge team for that watch, until relieved.

It is important that the bridge team works together closely, both within a particular watch and across watches, since decisions made on one watch may have an impact on another watch.

The bridge team also has an important role in maintaining communications with the engine room and other operating areas on the ship.

When the master has arrived on the bridge, his/her decision to take over control of the bridge from the OOW must be clear and unambiguous.

Duties should be clearly assigned, limited to those duties that can be performed effectively, and clearly prioritised.
Team members should be asked to confirm that they understand the tasks and duties assigned to them.

The positive reporting on events while undertaking tasks and duties is one way of monitoring the performance of bridge team members and detecting any deterioration in watchkeeping performance.

The ability of ship's personnel to co-ordinate activities and communicate effectively with each other is vital during emergency situations. During routine sea passages or port approaches the bridge team personnel must also work as an effective team.

A bridge team which has a plan that is understood and is well briefed, with all members supporting each other, will have good situation awareness. Its members will then be able to anticipate dangerous situations arising and recognise the development of a chain of errors, thus enabling them to take action to break the sequence. (See T24.)

1.2.4 THE USE OF ROUTEING

Use of routeing in accordance with general provisions on ships' routeing
Instructors should refer to reference R3 for guidance on this topic.

1.3 Use of Radar and ARPA to Maintain Safety of Navigation
See IMO Model Course No. 1.07, Radar Navigation - Operational Level and STCW 1995 Regulation I/12

1.4 Use of ECDIS to Maintain Safety of Navigation
See IMO Model Course 1.27

1.5 1.4 Respond to Emergencies
By their nature, emergencies are unique incidents calling for individual methods of dealing with them. However, all accidents of a particular type will have certain things in common and the response to them will require certain actions in all cases. It is those parts which should be dealt with in this subject.

Much of the subject can usefully be covered by class discussion with the aim of encouraging trainees to suggest the actions they would take in response to the various emergencies, to consider the likely results of those actions and to weigh them against possible alternatives. If a trainee has actual experience of any of the topics covered, he should be asked to describe the occurrence and the measures taken to the remainder of the class. The instructor will lead the discussions and should point out any suggested actions which are definitely wrong and give his reasons.

1.5.1 1.4.1 PRECAUTIONS FOR THE PROTECTION AND SAFETY OF PASSENGERS

Contingency plans for response to emergencies
Trainees should be aware of the regulations regarding the preparation and display of muster lists and instructions and the duties which will be included. In addition to knowing what their specific duties are, they should know the overall procedure for dealing with any emergency so that they could take over the duties of someone else who is missing or injured, if necessary. That involves knowing what might happen and what to do if the situation arises.

Under a requirement of MARPOL every vessel over 500gt is required to have a shipboard oil spill emergency plan (SOPEP) and this plan should be periodically exercised. The trainees understand their likely roles in the ship's plan.

**Precautions of the protection and safety of passengers in emergency situations**
The SOLAS regulations list the duties related to passengers which must be assigned to members of the crew. Other duties may be necessary, depending upon the circumstances and the design of the ship.

1.5.2 4.4.2—**INITIAL ACTION FOLLOWING COLLISION OR GROUNDING**

21 hours

**Precautions to be taken when beaching a vessel**
Beaching is an emergency measure, normally undertaken to prevent a ship from foundering. With the ship aground, there is a chance that temporary repairs can be made and the ship refloated. In any case, salvage operations will be simpler than for a submerged ship. Additionally, the transfer of passengers and crew from a beached vessel can be organized much more safely than the abandonment of a sinking ship.

Although a gently shelving beach of mud, sand or gravel is ideal, in many cases the urgency of the operation will dictate that the nearest beach is used regardless of the nature of the bottom. Similarly, the state of tide can seldom be chosen.

Dropping bower anchors during beaching is of doubtful value. If dropped too early they may prevent the ship from getting firmly ashore, if dropped too late they are ineffective for hauling the ship off. The ship may end up resting on the anchors, resulting in further damage to the bottom.

An anchor or anchors leading offshore from the stern are required to prevent the ship being driven further ashore by strong onshore winds. They will also assist in refloating the ship when repairs have been completed. A small ship could carry out a kedge or spare bower anchor, using her boats. A larger ship with a heavier anchor, particularly if equipped with totally enclosed GRP boats, would need the assistance of a tug or salvage craft.

Overall the trainee should be able to explain the factors to be taken into consideration before deciding on beaching a vessel and be able to make plan for actions before, during and after beaching.

**Actions to be taken on stranding**
Many of the actions to take after beaching a ship apply also to stranding.
Stranding may range from running aground on a soft bottom while manoeuvring to a sheltered estuary to striking an exposed rocky coast at full sea speed. The response necessary clearly depends upon the severity of the accident, and a range of possibilities should be discussed during lectures.

**Actions to be taken following a collision**
Where collision has resulted in the release of flammable or toxic gases, the ships should not remain embedded but be separated as quickly as possible. They should also be separated in conditions of rough sea or swell as the working together of the ships may cause further serious damage.

When checking for damage following a collision, the whole ship should be examined as far as possible. Decks, hatch coamings and covers and side plating may be cracked or distorted at points well removed from the point of impact.

**Means of limiting damage and salving the ship following a fire or explosion**
Trainees should consider what can be done to plug holes, make temporary repairs and shore up damage, using materials which can be expected to be available aboard ship.

**Procedure for abandoning ship**
This section supplements the training detailed in IMO model course 1.23, in which details of survival craft launching arrangements, equipment and its use and survival techniques are covered.

Trainees should be asked to consider what actions they would take in the event of some survival craft being unusable as a result of fire or a very heavy list, for example.

**Use of auxiliary steering gear and the rigging and use of jury steering arrangements**
The textbook gives examples of jury steering arrangements which have been produced with considerable ingenuity on the part of ships' officers concerned. Trainees should be restricted to using material which would be available aboard ship when answering questions on jury steering arrangements or jury rudders.

**1.5.3 1.4.3 RESCUING PERSONS FROM THE SEA, ASSISTING A SHIP IN DISTRESS AND PORT EMERGENCIES 4 hours**

**Rescue of persons from a vessel in distress or from a wreck**
Unless the situation is critical, conditions should be assessed carefully and a plan prepared before initiating rescue action. If the survivors are in no immediate danger, and existing conditions make rescue hazardous, consider delaying the rescue until weather conditions have improved or until daylight. Try to establish communications with the survivors to obtain information about their condition and to inform them of the intended method of rescue.

Direct transfer of survivors from a wreck to the ship requires nearly calm conditions and normally rescue boats or motor lifeboats will be used.
During the launching of boats, lifelines, lifebuoys, ladders and nets should be ready in case somebody falls overboard or a boat overturns.

Going alongside a wreck may be difficult. On the lee side the approach may be obstructed by wreckage and if the wreck is drifting quickly the boat will have difficulty getting away from the side. Sea conditions may make it impossible to approach from the weather side and, since the wreck will probably drift faster than the boat, it will be difficult to remain close enough to transfer survivors. An approach from the weather side is the only possibility when the wreck is on fire or releasing toxic fumes, in which case survivors may have to jump into the water to be picked up by the boats.

If weather conditions make the use of boats too hazardous and it is not possible to wait for conditions to moderate, a liferaft on a stout line may be towed or floated to the wreck or may be hauled out to the wreck after making connection by line-throwing apparatus. The painter fitted to the liferaft is not heavy enough to be used in this manner.

At the rescue ship, preparations for the transfer of survivors include the provision of a boat rope, nets, ladders, lines and crew standing by to assist. The use of a liferaft alongside as a landing stage releases the boat quickly if it is necessary to make several journeys. Survivors who have been in the sea or survival craft for some time may be suffering from cold, fatigue and sea-sickness and be unable to do much to help themselves.

**Actions which can be taken when emergencies arise in port**

Actions to take in the event of fire in port are mentioned in the references. It some ports there is an obligation to call the local fire service as soon as any fire is discovered on board. This may also be a shipping company standing instruction. Not calling for shore assistance until it is apparent that the fire cannot be controlled by the ship's equipment can result in a much more serious situation for the fire service and the ship.

The decision to put to sea for reasons of safety rests with the master, but the officer in charge of the watch should be aware of the circumstances in which to call the master.

**Measures for assisting a vessel in distress**

Some practical aspects of this topic are fully covered in the model course, 1.23 Proficiency in Survival Craft and Rescue Boats other than Fast Rescue Boats.

The need for agreement on the method of tow and the preparations necessary should be emphasised. The yawing of the towed vessel increases the stress on the towing arrangements and reduces the speed. The towed vessel should be steered to reduce the yaw to a minimum, although it will probably prove impossible to prevent it altogether.

Disconnecting the tow, particularly in confined waters at a port approach, can be a critical operation and should be planned with the same care as connecting the tow. (See R16.)
1.6  1.5  Respond to a Distress Signal at Sea

1.6.1  1.5.1 SEARCH AND RESCUE  

**MERSAR IAMSAR**

The syllabus for training in search and rescue is contained in the IMO model course, Maritime Search and Rescue Co-ordinator Surface Search. That course is designed to provide a thorough knowledge and understanding of the IMO Merchant Ship Search and Rescue Manual (MERSAR) International Aeronautical and Maritime Search and Rescue (IAMSAR) Volume III such that trainees will be able to use it effectively when faced with a search and rescue situation.

Model course 2.02 satisfies the requirements concerning search and rescue at the level of master and chief mate. When the syllabus is used as part of the model course for officers in charge of a navigational watch, the aim should be to provide trainees with an overall knowledge and understanding of the contents of MERSAR and how a search and rescue operation would be conducted. The depth of treatment of those parts, such as search planning, which are specifically the master's responsibility needs only to be sufficient to complete the overall view of the operation.

The entry standards for the course stipulate experience in plane navigation and plotting, the interpretation of weather maps and familiarity with emergency communications procedures. Account should be taken of those prerequisites when deciding where to introduce this subject into the course.

1.7  1.6  English Language

**English Language**

The requirements for English language knowledge are specified in STCW 2010 in Table A-II/1 and noting the guidance in the Code Section B-IV/2 paragraph 36.1 and B-VI/1 paragraph 7 which states that English language, both written and spoken is necessary for the exchange of communications relevant to the safety of life at sea.

A new IMO model course 3.17 on Maritime English is will be based on a clearly defined entry standard in general English, deals with maritime terminology and the use of English for the purposes of using charts and other nautical publications, understanding meteorological information and communicating with other ships or coast stations concerning ship's safety and operation, including the use of the IMO Standard Marine Navigational Vocabulary, as replaced by the IMO Standard Marine Communications phrases.

The course also includes the vocabulary needed to make use of and understand manufacturers' technical manuals and specifications to converse with technical shore staff concerning ship and machinery repairs.
1.8 1.7 Transmit and Receive Information by Visual Signalling

1.8.1 1.7.1 TRANSMIT AND RECEIVE SIGNALS BY MORSE LIGHT  40 hours

Signalling by Morse Code
Proficiency in Morse signalling is a matter of regular practice. Several short sessions each week would be preferable to a single longer one. The lecturing time shown in the subject outline is intended for dealing with procedures. The signalling facilities should be available for trainees who wish to practice in their own time.

The instructor should ensure that each trainee can send and receive the distress signal SOS by Morse at the required speed of not more than 16 characters per minutes as well as receive it.

1.8.2 1.7.2 USE THE INTERNATIONAL CODE OF SIGNALS  19 hours

International Code of Signals
As an aid to learning, trainees can be encouraged to produce for themselves sets of cards showing a flag or pendant on one side with the letter or numeral and single-letter meaning on the other. Alternatively, commercially made "flash cards" may be purchased. These can be used for individual learning or self-testing.

Sufficient exercises in coding and decoding should be provided to ensure that trainees are thoroughly familiar with the use of the Code. Particular attention should be paid to the use of the medical section and its tables of complements.

Trainees should be aware that single-letter signals for use between an ice-breaker and assisted vessel are provided in Chapter XIII but they should not be expected to remember the signals.

1.8 Manoeuvre the Ship

1.8.1 SHIP MANOEUVRING AND HANDLING  15 hours

The effects of various deadweights, draughts, trim, speed and under-keel clearance on turning circles and stopping distances
Point out to trainees that the greater turning circle and stopping distance experienced in shallow water should be one of the factors considered when deciding on a safe speed.

Effect of wind and current on ship handling
Where a training vessel or ship handling simulator is available, the effects of wind and current can be demonstrated to trainees. Exercises in anchoring, or positioning the vessel as if for anchoring, are particularly suitable for trainees to practice. They can be combined with exercises in the use of navigational aids. Trainees should be asked to act as a bridge team to follow a prepared approach to the anchoring position. Their roles in the bridge team should be rotated in subsequent exercises.
Manoeuvres for the rescue of a man overboard
The wheelhouse poster may show headings at which to put the wheel over different from those shown in the man-overboard manoeuvres in MERSAR IAMSAR. The headings shown on the wheelhouse poster should be used as they have been determined for that ship, whereas MERSAR IAMSAR gives only a general indication of when to shift the helm. Man-overboard procedures can be practiced, using a training vessel, (V7).

Squat and shallow-water and similar effects
Squat is not easily measured, so the information supplied to a ship consists of estimated values. The actual squat experienced may differ somewhat from those values in the prevailing circumstances.

In any case, since squat is proportional to the square of the speed, a reduction in speed effectively reduces the resulting sinkage and change of trim. See reference T66.

Proper procedures for anchoring and mooring
This section covers the knowledge required by a junior officer for the supervision of anchoring or mooring operations. Attention should also be drawn to any national code of safe working practices relating to these operations. Guidance on safety measures to be taken during anchoring and the handling of mooring ropes and wires is contained in the references.

It is recommended that, when using portable radio apparatus, the ship’s name should be included in orders to the officer in charge of anchoring to avoid possible confusion with orders from nearby ships.
Part C1: Detailed Teaching Syllabus

Introduction

The detailed teaching syllabus is presented as a series of learning objectives. The objective, therefore, describes what the trainee must do to demonstrate that the specified knowledge or skill has been transferred.

Thus each training outcome is supported by a number of related performance elements in which the trainee is required to be proficient. The teaching syllabus shows the *Required performance* expected of the trainee in the tables that follow.

In order to assist the instructor, references are shown to indicate IMO references and publications, textbooks and teaching aids that instructors may wish to use in preparing and presenting their lessons.

The material listed in the course framework has been used to structure the detailed teaching syllabus; in particular,

- Teaching aids (indicated by A)
- IMO references (indicated by R) and
- Textbooks (indicated by T)

will provide valuable information to instructors.

Explanation of Information Contained in the Syllabus Tables

The information on each table is systematically organised in the following way. The line at the head of the table describes the FUNCTION with which the training is concerned. A function means a group of tasks, duties and responsibilities as specified in the STCW Code. It describes related activities which make up a professional discipline or traditional departmental responsibility on board¹.

In this Model Course there are three functions:

- Navigation at the Operational Level
- Cargo Handling and Stowage at the Operational Level
- Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level.

The header of the first column denotes the **COMPETENCE** concerned. Each function comprises a number of competences. For example, the Function 1, Navigation at the Operational Level, comprises a total of eight COMPETENCES. Each competence is uniquely and consistently numbered in this model course.

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The first competence is **Plan and Conduct a Passage and Determine Position**. It is numbered 1.1, that is the first competence in Function 1. The term competence should be understood as the application of knowledge, understanding, proficiency, skills, experience for an individual to perform a task, duty or responsibility on board in a safe, efficient and timely manner.

Shown next is the required **TRAINING OUTCOME**. The training outcomes are the areas of knowledge, understanding and proficiency in which the trainee must be able to demonstrate knowledge and understanding. Each **COMPETENCE** comprises a number of training outcomes. For example, the competence **Plan and Conduct a Passage and Determine Positions** comprises a total of seven training outcomes. The first is in **CELESTIAL NAVIGATION**. Each training outcome is uniquely and consistently numbered in this model course. Celestial Navigation is numbered 1.1.1. For clarity training outcomes are printed in black on grey, for example **TRAINING OUTCOME**.

Finally, each training outcome embodies a variable number of required performances - as evidence of competence. The instruction, training and learning should lead to the trainee meeting the specified required performance. For the training outcome Celestial Navigation, there are 11 areas of performance. These are:

1.1.1.1 Solar system (4 hours)
1.1.1.2 Celestial sphere and equinoctial system of co-ordinates (4 hours)
1.1.1.3 Hour angle (4 hours)
1.1.1.4 Daily motion and horizontal system of coordinates (6 hours)
1.1.1.5 Sextant and altitude corrections (6 hours)
1.1.1.6 Amplitude (2 hours)
1.1.1.7 Time and equation of time (2 hours)
1.1.1.8 Nautical Almanac (6 hours)
1.1.1.9 Latitude by meridian altitude (3 hours)
1.1.1.10 Pole Star observations (3 hours)
1.1.1.11 Position fixing (20 hours)

Following each numbered area of required performance there is a list of activities that the trainee should complete and which collectively specify the standard of competence that the trainee must meet. These are for the guidance of teachers and instructors in designing lessons, lectures, tests and exercises for use in the teaching process. For example, under the topic 1.1.1.1 Solar system, to meet the required performance, the trainee should be able to:

- describe the composition and dimensions of the solar system
- identify planets useful for navigation
- describe the earth's elliptical orbit, and state approximate perihelion and aphelion distances and dates and so on.

IMO references (Rx) are listed in the column to the right hand side. Teaching aids (Ax), videos (Vx) and textbooks (Tx) relevant to the training outcome and required performances are placed immediately following the title.
It is not intended that lessons are organised to follow the sequence of required performances listed in the Tables. The Syllabus Tables are organised to match with the competence in the STCW Code Table A-II/1. Lessons and teaching should follow college practices. It is not necessary, for example, for celestial navigation to be studied before terrestrial and coastal navigation. What is necessary is that all the material is covered and that teaching is effective to allow trainees to meet the standard of the required performance.
1.1 PLAN AND CONDUCT PASSAGES AND DETERMINE POSITION

1.1.1 CELESTIAL NAVIGATION

Training Outcome:
Demonstrates a knowledge and understanding of:

1.1.1 Position Fixing by Celestial Navigation System

Textbooks: T13, T14
Teaching aids: A1, A4, A13, A14, A17, A21, A23, A24, A25, A26

Required performance:

1.1.1.1 Solar system (4 hours)

- describes the composition and dimensions of the solar system
- names inferior and superior planets
- describes the earth's elliptical orbit, and states approximate perihelion and aphelion distances and dates
- explains the eccentricity of the earth's orbit
- describes the inclination of the earth's axis to the plane of the orbit and the stability of the axis (ignoring precession) and shows how it causes its effect on seasons changes
- states the dates of the solstices and equinoxes
- explains the concept of the earth's axial rotation giving day and night
- explains the varying length of daylight through the year
- explains daylight and darkness conditions in various latitudes at the solstices and equinoxes
- describes the significance of the tropics of Cancer and Capricorn and of the Arctic and Antarctic Circles

1.1.1.2 Celestial sphere and equinoctial system of co-ordinates (4 hours)

- defines describes the celestial sphere
- explains the apparent annual motion of the sun and the concept of the ecliptic
- defines 'celestial poles', 'celestial meridians', 'equinoctial' and the 'obliquity of the ecliptic'
explains states that the equinoctial as a fixed reference plane and the
direction of the First Point of Aries as a reference direction (ignoring the
effect of precession)
- describes the equinoctial system of co-ordinates and defines sidereal hour
angle, declination and polar distance
- extracts information from the star diagrams in the Nautical Almanac

1.1.1.3 Hour Angle (4 hours)
- describes the concept of the earth's axial rotation causing change in the
hour angle of bodies
- defines 'Greenwich Hour Angle (GHA)', 'Local Hour Angle (LHA)' and
longitude, and explains their relationship
- describes the rate of change of GHA of the sun and Aries
- identifies the tabulation of SHA, GHA, and declination (and 'd' and 'v'
corrections) in the Nautical Almanac for all celestial bodies
- determines the geographical position of a body for any given GMT

1.1.1.4 Daily Motion and Horizontal System of Co-ordinates (6 hours)
- defines 'rational horizon', 'zenith' and 'nadir'
- defines 'vertical circle' and 'prime vertical circle'
- defines 'elevated pole' and 'depressed pole'
- proves that the altitude of the elevated pole is equal to the observer's
latitude
- defines the observer's upper and lower celestial meridian
- identifies the apparent daily path of all bodies
- defines 'true altitude', 'azimuth', and 'true zenith distance'
- explains the relationship between azimuth, quadrantal bearings and 360°
notation bearing
- recognizes rising and setting points and defines amplitude
- explains the meaning of the term circumpolar and describes the conditions
necessary for a body to be circumpolar
- describes the condition necessary for a body to cross the prime vertical
- recognizes the parts of the PZX triangle
- draws figures on the plane of the rational horizon and of the observer's
celestial meridian, using the equidistant projection to illustrate navigational
problems and principles

1.1.1.5 Sextant and Altitude Corrections (6 hours)
- defines 'sextant altitude'
- describes the parts of a sextant
- demonstrate how to retrieve and return a sextant into the storage box
- demonstrates how to read a sextant
- shows how to correct a sextant into which has been introduced one or more of error of perpendicularity, side error or index error
- demonstrates how to find the index error of the sextant by the horizon
- describes how to find the index error of the sextant by the sun
- uses the sextant for taking vertical and horizontal angles
- describes the purpose of altitude correction
- defines 'visible', 'sensible' and 'rational' horizons
- defines 'observed altitude' and 'true altitude'
- defines 'dip', 'refraction', 'semi-diameter' and 'parallax', and explains their causes
- applies index error
- applies the corrections for the items listed in 2.5.10 and explains the factors determining their magnitude
- illustrates the effect of terrestrial refraction on the dip and distance of the sea horizon
- demonstrates the use the altitude correction tables in the Nautical Almanac, including reference to critical tables, interpolation tables and low-altitude correction tables
- obtains the true zenith distance from the true altitude of the body

1.1.1.6 Amplitude (2 hours)
- determines the observed altitude of the sun when the true altitude is zero
- explains the effect of latitude on the accuracy of amplitude observations
- calculates the LAT and LMT of the theoretical and visible rising and setting of the sun
- extracts information from the tabulation of the rising and setting of the sun in the Nautical Almanac

1.1.1.7 Time and Equation of Time (2 hours)
- defines the apparent solar day and states the relationship between LHA (sun) and LAT
- defines the ‘sidereal day’ and states that it is a fixed time interval
- explains the reasons for the sun's irregular rate of change of SHA and hence the necessity to adopt the astronomical mean sun for timekeeping purposes
- defines describes the equation of time (ET) and its components
- determines the ET from the Almanac and its sign of application
- defines GMT, LMT and longitude
- defines zone times and standard time
- explains how to alter the ship's time during a passage with increasing or decreasing longitude
- demonstrates the use of time signals
- calculates determines the error of a chronometer or watch

1.1.1.8 Nautical Almanac (6 hours)
- describes the information contained in general in the Nautical Almanac (NA) and in detail in the daily pages
- uses the tables of corrections and incremental corrections in the Nautical Almanac
- finds the LHA of a body, given the date, GMT and longitude of the observer
- explains the importance of the First Point of Aries
- finds the LHA of Aries, given the date, GMT and longitude of the observer
- explains what is meant by the sidereal hour angle of a star and obtains it from the Nautical Almanac
- derives the LHA of a star from the LHA of Aries and the SHA of the star
- demonstrates the uses the information in the Nautical Almanac to obtain the LMT of the meridian passage of a body to the nearest minute and interpolates for the observer's longitude when necessary

1.1.1.9 Latitude by Meridian Altitude (3 hours)
- applies the true zenith distance of a body when it is on the observer's meridian to the declination of the body, to obtain the observer's latitude
- applies these correctly when the declination and latitude have the same name
- applies these correctly when the declination and latitude have different names
- states describes the relationship between the altitude of the elevated pole and the latitude of the observer
- explains what is meant by a circumpolar star, and the terms upper and lower transit
- finds the value of the polar distance of the body, using its declination
- applies the polar distance to the true altitude of a body at lower transit to find the altitude of the elevated pole and the latitude
- states describes the direction of the position line through the observer when taking a meridian altitude

1.1.1.10 Pole Star Observations (3 hours)
- identifies certain major stellar constellations and navigational stars, describes their movement relative to Polaris and the movement of Polaris with change of latitude
- identifies Polaris
- identifies some major constellations
- describes the motion of the stars about Polaris
- describes the relationship between the altitude of Polaris and the observer’s latitude
- deduces from 2.10.4 that the true altitude of Polaris can be used to find the latitude of the observer
- obtains the corrections, \(-1^\circ, +a_0, +a_1, +a_2\), from Pole Star tables in the 'Nautical Almanac' and applies them to the altitude of Polaris to find the latitude of the observer
- finds the true azimuth of Polaris from the tables and the direction of the position line

1.1.1.11 Position Fixing (20 hours)
- combines the equinoctial and horizon system of co-ordinates to determine the centre and radius of a position circle and its direction in the vicinity of a selected position
- applies the principles of a method of enabling the navigator to draw a small part of the position circle in his vicinity to a practical problem
- states explains the assumptions made when plotting celestial position lines and the circumstances in which they may become significant
- determines the direction of a position line through an observer and a position through which it passes
- defines and evaluates the co-latitude, polar distance and zenith distance and uses them as the sides of the PZX triangle
- solves the PZX triangle to find the calculated zenith distance of the body when it is out of the meridian
- applies this calculated zenith distance to the true zenith distance of the body to find the intercept and the intercept terminal point

1.1.2 TERRESTRIAL AND COASTAL NAVIGATION

Training Outcome:
Demonstrates a knowledge and understanding of:

1.1.2 Terrestrial and Coastal Navigation System

Textbooks: T1, T2, T3

Required performance

1.1.2.1 Definitions - Earth (7 hours)
- defines 'great circle', 'small circle', 'spherical angle', 'spherical triangle', 'poles of a great circle'
- defines 'earth's poles', 'equator' and 'meridians'
- defines 'latitude' and 'parallels of latitude', 'prime meridian' and 'longitude'
- defines 'difference of latitude' and 'difference of longitude'
- describes the earth as an ellipsoid.
- defines 'compression', and states its value
- defines 'international nautical mile', 'cable' and 'knot'

1.1.2.2 Charts (12 8 hours)
- demonstrates basic knowledge of chart projections
- defines 'natural scale' of a chart
- states describes the requirements of a chart appropriate for marine navigation
- identifies the Mercator chart as a mathematical projection and understands the principles of its construction.
- describes the properties of the chart and the degree to which it meets navigational requirements and also its limitations
- demonstrates the use of a chart catalogue
- demonstrates the correcting of charts according to Notices to Mariners
- demonstrates knowledge of electronic charts (See also section 1.5)
- describes the differences between Vector and Raster electronic charts
- explains the major characteristics of ECDIS data such as data term and definition; data contents; data structure; attribute; data quality and it accuracy
- describes the terms and definitions used in the context of ECDIS
- describes ECDIS display characteristics
- explains the scope and selection of chart data display categories

1.1.2.4 Datums (2 hours)
-- explains the rotation of the earth about its axis
-- defines describes the directions on the earth's surface
-- describes the direction of the ship's head on a gyro-compass (gyro course)
-- describes the direction of the ship's head on a magnetic compass (compass course)

1.1.2.5 Distances (3 hours)
- states describes the approximate polar and equatorial circumferences of the earth
- demonstrates how to measure the distance between two positions on a Mercator chart based on the latitude of the two positions

1.1.2.6 Position Lines and Positions (15 hours)
- defines a position
- gives the radar distance off a charted object and plots its position circle on a chart
- plots a position on the chart from simultaneous cross bearings and from bearing and distance off
- explains the methods used to obtain simultaneous cross bearings with least error
- defines 'dead reckoning position (DR)', 'estimated position (EP)' and 'fixed position'
- plots a dead reckoning position on the chart and marks accordingly
- plots an estimated position on the chart and marks accordingly
- plots position lines - straight line, circle, hyperbola
- finds a position line by bearing, horizontal angle, vertical sextant angle, and transit line and radio aids
- determines a position by a combination of bearing, distance and the methods in the above objective
- finds a position by simultaneous bearings of two objects
- finds the distance that the ship will pass off a given point when abeam
- constructs a position line to clear a navigational danger by a given distance

1.1.2.7 Sailings (34 hours)
- defines 'departure' and states the relationship to difference of longitude
- defines 'true course' and 'rhumb line'
- derives the plane sailing formulae
- explains the relationship between departure and difference of longitude in cases involving a change of latitude, by using mean latitude
- uses the parallel sailing formula:
  \[
  \text{departure} \quad = \quad \cos \text{ of latitude} \\
  \text{diff. of longitude}
  \]
- calculates the distance between two positions on the same parallel of latitude
- calculates the difference of longitude for a given distance run along a parallel of latitude
- derives the final position after sailing along a parallel of latitude
- demonstrates the uses the plane sailing formulae
- understands the meaning of, and can derive, mean latitude
- calculates the correct departure to use in a plane sailing problem
calculates the course and distance between two positions, using the plane sailing formula
- calculates a DR position or an estimated position by using the plane sailing formula, given compass course and compass error, distance by log, estimated speed, tidal and current information and leeway
- describes the layout of a traverse table
- derives the information required in a parallel or plane sailing problem, using a traverse table or calculator
- solves problems of plane sailing, using a calculator
- solves problems of DR and fixing positions, using plotting charts
- states the Mercator sailing formula
- uses the Mercator formula to calculate course and distance between two positions
- uses the Mercator formula to calculate the final position, given the initial position, course and distance
- demonstrates understanding of great circle sailing including composite and limited latitude great circles
- calculates initial course and distance of a great-circle track
- calculates composite great circles
- demonstrates the use of gnomonic charts for plotting the great circle between two points
- transfers a great circle from a gnomonic to a Mercator chart

1.1.2.8 Chartwork Exercises (70 82 hours)

- defines ‘course’ and ‘distance’
- lays off true course between two positions and marked with appropriate symbol
- finds the distance between two positions
- calculates the speed between two positions
- defines 'set', 'rate', 'drift' and 'leeway' due to wind
- defines describes 'ship's speed', 'effective speed', 'course and 'distance made good', 'applied leeway'
- finds the course and distance made good with a tidal stream or current
- finds the course to steer, allowing for tidal stream or current
- finds the set and rate of tidal stream or current from charts or tables
- explains the term 'running fix' and uses the method to plot a position
- finds positions by running fix in a tidal stream or current
- calculates the actual set and rate of tidal stream or current from DR and fixed positions

1.1.2.9 Information from Charts, Lists of Lights and Other Publications

(44 hours)

- recognises and demonstrates the use of the symbols and abbreviations on a chart, especially lighthouses, buoys, beacons, radio beacons and other navigational marks
- identifies the characteristics and range of lights
- calculates the distances of sighting lights and dipping distances
- identifies the symbols for chart depths and nature of the bottom and explains the use of soundings
- recognises coastlines, coast and radar-responsive targets
- interprets coastline contours, bottom topography, depths and nature of bottom
- uses the tidal information given on a chart
- recognises traffic lanes and separation zones
- recognizes the different types of charts overlaid with lattice lines
- uses lattice charts
- explains the danger of placing implicit reliance upon floating navigational aids
- explains the danger of approaching navigational aids too closely
- obtains and appraises information from navigational publications including sailing directions, notices to mariners, radio navigational warnings and ship’s routeing information.
- demonstrates simple passage planning and execution including use of sailing directions, tide tables, radio navigational warning and ship’s routeing information within parameters established by the Master
- explains the use of clearing marks and horizontal and vertical danger angles
- recognises suitable passages, approaches and anchorages in clear weather and thick weather, using radar-responsive targets demonstrate planning of a passage between two ports from berth to berth using the procedures for
passage planning as per the Guidelines for Voyage Planning provided by IMO in Resolution A.893(21)

1.1.2.10 IALA Maritime Buoyage System (2 hours)
explains the principles and rules of the International Association of Lighthouse Authorities (IALA) Maritime Buoyage System, Systems "A" and "B"
recognises the lights and shapes displayed on lateral and cardinal marks
recognises the lights and shapes displayed on other types of buoys in the system

1.1.2.11 Tides (18 hours)
- explains the basic theory of tides
- defines 'spring tides', 'neap tides', 'height of tide' 'high water' and 'low water', 'mean high water springs', 'mean high water neaps', 'mean low water springs', 'mean low water neaps', 'range', 'chart datum'
- calculates the spring and neap ranges for standard and secondary ports
- finds the predicted time and height of high and low water at standard and secondary ports

1.1.2.12 Keeping a Log (3 hours)
- states describes the rules, regulations and common practice regarding keeping a log of a navigational log and voyage records
- describes the proper keeping of different kinds of log during ocean passages, coastal navigation and in port in line with the requirement in the company's ISM Safety Management System

1.1.3 ELECTRONIC SYSTEMS OF POSITION FIXING AND NAVIGATION

Training Outcome
Demonstrates a knowledge and understanding of
1.1.3 The Electronic Position Fixing System

Textbooks: T37, T60, T64
Training aids: A1, A27, A28

Required performance:
1.1.3.1 Basic Principles of Hyperbolic Navigation Systems (2 hours)
- describes, with reference to position fixing, the nature of a hyperbola
- draws a hyperbolic pattern associated with two foci, with the baseline divided into an exact number of equal divisions
- explains the principles of the hyperbolae being position lines
- describes the causes of ambiguity and reduced accuracy in the baseline extension area
- combines two hyperbolic patterns to illustrate the method of ascertaining position

1.1.3.2 Loran-C System (12 hours)
- describes the basic Loran-C and eLoran system
- draws a block diagram of a Loran-C receiver, showing how time differences are measured
- describes how ambiguity in a position line is resolved
- explains why third-cycle matching is used
- explains how the use of sky waves affects the measured time difference
- states the typical radii of coverage areas
- identifies the Loran chart and the additional information printed thereon
- switches on equipment; selects chain and relates the time differences obtained to the correct station pair
- recognises warnings which indicate that the system may be faulty

1.1.3.3 Enhanced Loran (e-Loran) (2 hours)
- describes the basic operating principles of eLoran
- describes the principal difference between eLoran and traditional Loran-C system.
- explains the use of eLoran when satellite services are disrupted.
- states that each user’s eLoran receiver will be operable in all regions where an eLoran service is provided.
- describes the control, operating and monitoring systems of eLoran.
states that eLoran transmissions are synchronized to an identifiable, publicly-certified, source of Coordinated Universal Time (UTC) by a method wholly independent of GNSS

explains the view mode and signal tracking of eLoran.

describes the advantages and limitations of eLoran

1.1.3.3 Satellite Navigation Systems

Global Navigation Satellite Systems (20 hours)

- describes the principles of operation of satellite navigation systems global navigation satellite systems aboard ship

- states that the system will provide continuous world-wide position-fixing capabilities

- states describes the intended level of accuracy of the system

1.1.3.4 GPS Systems

- describes the basic principles of the Global Positioning System (GPS)

- describes the system configuration

- states the frequencies that are used

- describes the C/A & P codes

- describes how the basic line measurement is obtained

- describes the Dilution of Precision (DOP)

- states describes the various DOPs that are used

- describes the various errors of GPS

- describes the reasons for selective availability and the effect it has on the accuracy of a fix

- describes differential GPS

- states describes the accuracy obtainable with GPS and how the accuracy can be downgraded

- explains WGS 84

- explains why a fix obtained from the GPS receiver cannot be plotted direct onto a navigational chart
- explains datum shifts

- describes the advantages and limitations of GPS

1.1.3.4 DGPS – Differential GPS (1 HOUR)

- describes the basic principle of Differential GPS

- describes how DGPS stations can transmit the corrections

- describes the Regional Satellite Navigation Systems such as China’s BeiDou (COMPASS) Navigation Satellite System, India’s Indian Regional Navigational Satellite System (IRNSS), Japan’s Quasi-Zenith Satellite System (QZSS) and France’s Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS).

- describes the limitation of the DGPS receiver

1.1.3.6 GLONASS (1 HOUR)

- describes the principle on which the GLONASS works

- explains the different satellite constellation configurations under GLONASS and GPS respectively

- describes the advantage of the receiver capable of operating both GLONASS and GPS “combined GPS/GLONASS receiver equipment”

- describes the limitation of the GLONASS system receiver

1.1.3.7 GALILEO (1 HOUR)

- explains the principle of Galileo as the European satellite navigation system.

- describes that Galileo comprises 30 medium earth orbit (MEO) satellites in 3 circular orbits.

- states the satellite geometry and dual atomic clocks in the Galileo system.

- states that atomic clock signal information is used to calculate the position of the receiver by triangulating the difference in received signals from multiple satellites.

- describes the limitations of the Galileo system receiver
1.1.4 ECHO-SOUNDERS AND SPEED MEASUREMENT (17 HOURS)

Textbooks: T37, T60
Training aids: A1, A29, A30
Training Outcome

Demonstrates a knowledge and understanding of:

1.1.4 Echo Sounders and Speed Measuring Logs

Required Performance:

1.1.4.1 Echo-Sounders (9 hours)
- describes the basic principles of marine echo-sounding equipment
- identifies the main components on a simple block diagram of an echo-sounder, and states the function of each
- states describes the accepted value of the velocity of sound in seawater and the limits within which the true value may lie
- states describes the physical factors which affect the velocity sound in seawater
- operates a typical echo-sounder and demonstrates an ability to carry out basic user maintenance, e.g. clean platen, change paper, change and adjust stylus
- distinguishes differentiates between range and phase, and demonstrates an awareness of the dangers of using the wrong phase
- distinguishes between inaccuracies caused by instrument and scale error and those caused by false echoes
- explains the causes of inaccuracies due to instrument or scale error and states their likely magnitude and measures that may be taken to eliminate them
- recognises the various types of “false” echo that may be observed, describes their formation and states the possible action to remove them from the trace
- describes the potential errors due to trim, heel and transducer separation

1.1.4.2 Speed Logs (8 hours)
- states describes the difference between ground-reference speed and water-reference speed
- describes the basic principles of the electromagnetic speed log
- describes the basic principles of the pressure-tube log
- explains the necessity of withdrawal of the tube before entering port
describes the basic principles of the acoustic-correlation log
-describes the basic principles of the Doppler speed log
-explains the "Janus" configuration to counteract the effect of ship's trim
-explains the dual-axis configuration and its use during docking operations
-lists the main error sources on the various types of logs
- states describes the accuracies of the various systems
-explains calibration of the log
-describes how ship's speed is transmitted to remote displays
-draws a schematic diagram showing how an indication of distance run is derived from a speed log

1.1.5
OMPASS - MAGNETIC AND GYRO (26 hours)

Training Outcome
Demonstrates a knowledge and understanding of :
1.1.5 The Magnetic and Gyro Compasses

Textbooks: T2, T13, T34, T37, T46, T59, T60
Training aids: A1, A4, A5, A14, A23, A26, A31, A32

Required Performance:

1.1.5.1 The Magnetism of the Earth and the Ship's Deviation (6 hours)
-explains the theory of magnetism as applied to ferromagnetic materials
-describes a simple magnet, its poles and the law of attraction and repulsion
-describes the magnetic field around a magnet
-describes qualitatively flux density and field strength
-describes magnetic induction and differentiates between 'hard' and 'soft' iron
-explains the meaning of the terms:
-- intensity of magnetization
-- permeability
-- magnetic susceptibility(no mathematical formula required)
-describes the magnetic field of the earth
- defines 'magnetic poles' and 'magnetic equator'
- defines 'angle of dip'
- explains how the earth's total field can be split into horizontal and vertical components
- defines 'magnetic variation' and explains why it is a slowly changing quantity
- explains states that a compass needle which is constrained to the horizontal can respond only to the horizontal components of the earth's field and the field due to the ship's magnetism
- describes the effect of introducing a disturbing magnetic force into the vicinity of a compass needle
- states that the direction and strength of a magnetic field may be represented by a vector
- uses a vector diagram to find the field at a point resulting from two given fields
- states that a compass needle will align itself with the resultant field
- defines the magnetic moment of a bar magnet as the product of the pole strength and the length of the magnet
- states that, for a suspended magnet vibrating in a magnetic field, \( T^2 \) is proportional to \( 1/H \), where \( T \) is the period of vibration and \( H \) is the field strength
- explains how the relative strengths of two fields may be found

### 1.1.5.2 The Magnetic Compass (11 6 hours)

- describes the construction of a liquid card magnetic
- sketches a section through the compass to show the float chamber, the pivot support and the arrangement of magnets
- explains how the card is kept practically horizontal in all latitudes
- states describes the composition of the liquid and explains how allowance is made for changes in volume of the liquid
- describes how to remove an air bubble from the compass bowl
- describes how to check that the card is turning freely on its pivot
- explains how the compass bowl is supported in the binnacle
- describes the marking of the lubber line and its purpose
- describes a binnacle and the arrangement of correcting devices provided
defines 'deviation' and states how it is named

illustrates with sketches the deviations on various headings produced by permanent magnetism with a pole or poles lying in the plane of the compass card

explains the need for care in the placing of portable items of magnetic material, including spare corrector magnets, or electrical equipment in the vicinity of compasses

explains the need for regular checking of the compass error

explains why compass error should be checked after a major alteration of course

explains why regular comparisons of standard compass, steering compass and gyro-compasses should be made

explains that the approximate error of the standard compass can be obtained by comparison with the gyro-compass if no other means is available

emphasizes taking bearings of celestial bodies and landmarks

1.1.5.3 The Gyro-Compass (14 6 hours)

-describes a free gyroscope and its gimbal mountings

-states that in the absence of disturbing forces the spin axis of a free gyroscope maintains its direction in space

-explains what is meant by gyroscopic inertia and precession

-describes the precession resulting from a torque about axes perpendicular to the spin axis

-explains that friction at gimbal pivots produces torques which give rise to precession

-states that the rate of precession is proportional to the applied torque

-defines states that 'tilt' as movement of the spin axis in the vertical plane

-defines states that 'drift' as the apparent movement of the gyroscope in azimuth resulting from the earth's rotation

-describes non-mathematically the apparent movement of a free gyroscope on the earth's surface, given its position and initial attitude

-uses the apparent motion of a celestial body in the direction of the gyro axis to aid the description above

-explains how a free gyroscope can be made north-seeking by the use of gravity control and describes the resulting oscillations of the axis

-describes the use of damping in azimuth and damping in tilt to cause settling of the axis and thus produce a gyro-compass

-explains that control and damping can be achieved by replacing the ballistic elements with electrical signals, provided by tilt sensors, to produce torques about the vertical and horizontal axes

-describes a familiar gyro-compass with particular reference to:
- the method of support
- control and damping arrangements
- the method of maintaining the heading indication in line with the axis of the gyro
-- the transmission of heading to repeaters

- demonstrates the starting of the gyro-compass and explains how to minimize settling time by slewing and levelling it to the correct heading
- states explains the necessary time for the compass to settle after switching on prior to sailing
- lists the settings to be made or adjusted while the compass is in use
- explains how the repeater system is switched on and aligned with the master gyro-compass
- describes the use of gyro input to the direction finder
- describes how gyro heading input is supplied to a radar installation
- describes the alarms fitted to a gyro-compass

1.1.5.4 Compass Corrections (12 6 hours)
- defines true, magnetic and compass north
- finds deviation and variation from tables and charts
- calculates true course from compass course
- calculates compass course from true course
- measures compass error, using a transit bearing
- applies compass error to the ship’s head and compass bearings to convert to true
- takes a compass bearing of a charted object and lays the true bearing off on the chart

1.1.5.5 Errors of the Compass and Azimuths (19 13 hours)
- obtains the error of the magnetic compass or gyro compass by comparing the compass bearing of the body with the true azimuth of the body obtained at the time of observation
- obtains the azimuth of the body from tables, using GMT of observation, information from the Nautical Almanac, LHA of the body and the observer’s DR position
- obtains from tables or by calculation, using the observer’s DR position and information from the Nautical Almanac, the true bearing of a heavenly body on rising or setting, i.e. solves an amplitude problem
- obtains the magnetic variation for the observer’s position, using isogonal lines or other information on the chart
- applies variations to the error of the magnetic compass to find the deviations for the direction of the ship’s head
- calculates compass error and gyro error, from transit bearings and bearings to distant fixed objects

1.1.5.6 Fluxgate Compass (1 hour)
- Defines singles axis and dual axis
- Explains basic operation
- Explains TMC
- Describes solid state type

1.1.6. STEERING AND CONTROL SYSTEMS

Training Outcome

Demonstrates a knowledge and understanding of:

1.1.6 Steering and control systems

Textbooks: T37, T60
Training aids: A1, A33

Required performance:

1.1.6.1 The Automatic Pilot (5 hours)
- explains the principle of an automatic pilot system
- lists and explains the functions of the manual settings
- describes the procedures for change-over from automatic to manual steering and vice versa
- explains what is meant by an adaptive automatic pilot and briefly explains how it functions
- describes the course monitor and the off-course alarm
- describes the operation of the course recorder log
- lists the other alarms fitted to the system
- states that the automatic pilot should be included in the steering gear testing prior to the ship’s departure
- explains the regulation regarding the use of the automatic pilot
- explains in the recommendation on performance, standards for automatic pilots
- explains the need for regular checking of the automatic pilot to ensure that it is steering the correct course
- states that the automatic pilot should be tested manually at least once per watch
- describes the factors to take into account regarding the change-over to manual control of steering in order to deal with a potentially hazardous situation

1.1.7 METEOROLOGY (79 hours)

Training Outcome

Demonstrates a knowledge and understanding of:

1.1.7 Meteorology

Textbooks: T42, T47, T48
Training aids: A1, A20, A34, A35, A36

1.1.7.2 Atmosphere and weather systems
1.1.7.3 Atmospheric structure and Pressure systems
1.1.7.10-12 Weather Reporting and Forecasting

Required Performance:
1.1.7.1 Shipborne Meteorological Instruments (5 hours)

- states describes the basic principle of a mercurial barometer
- states describes the basic principle of an aneroid barometer
- reads the atmospheric pressure from an ordinary aneroid barometer and precision aneroid barometer if available
- reads the temperature from a thermometer
- states describes the function of a hygrometer
- states describes the basic principles of wind sensors and demonstrates ordinary readings of wind speed
1.1.7.2 The Atmosphere, its Composition and Physical Properties (4 hours)

- describes the composition of the earth's atmosphere, mentioning dry air and its constituents, water vapour and aerosols
- draws a typical vertical temperature profile through the lower 100 km of the earth's atmosphere
- defines 'troposphere', 'tropopause', 'stratosphere', 'stratopause', 'mesosphere', 'mesopause' and 'thermosphere'
- describes the main features of the troposphere
- describes the importance of the sun as the principal energy source for atmospheric processes
- describes the nature of solar radiation, (scattering, reflection and absorption)
- explains the effect on insolation of a variation in latitude
- explains the effect on insolation of a variation in the sun's declination
- explains the effect on insolation of a variation in the length of daylight
- defines 'water vapour'
- describes the properties of water vapour in the atmosphere
- defines 'evaporation', 'condensation', 'latent heat of vaporization'
- defines 'saturated air'
- describes the processes of mixing, cooling and the evaporation of water vapour, by which a sample of air may be brought to saturation
- defines 'dewpoint', 'absolute humidity', 'relative humidity', 'vapour pressure'

1.1.7.3 Atmospheric Pressure (4 hours)

- states that pressure equals force per unit area
- states that the atmosphere exerts a pressure on any surface placed within it
- states that the atmospheric pressure on a unit area of a surface is equal to the weight of the "air column" extending from that surface to the outer fringes of the atmosphere
states that atmospheric pressure decreases with height above sea level.

- states that atmospheric pressure acts in all directions.

- states that the basic unit of pressure is N/m$^2$.

- states that 1 millibar = $10^{-3}$ bar = $10^2$ N/m$^2$.

- states that the atmospheric pressure at sea level normally varies between about 940 mbar and 1050 mbar.

- states that the average pressure at sea level is 1013.2 mbar.

- states that the surface pressure rises if air is added to the 'column' above the surface, and vice versa.

- defines 'isobar'.

1.1.7.4 Wind (8 hours)

- defines 'wind'.

- describes the Beaufort scale of wind force.

- explains qualitatively the pressure gradient force.

- explains qualitatively the Coriolis (geostrophic) force.

- explains the surface wind circulation around high and low-pressure centres.

- inserts surface wind directions on a map showing pressure distribution and indicates relative wind speeds at various places within the pressure field.

- states explains Buys-Ballot's Law.

- explains the method of estimating the strength of the wind from the appearance of the sea surface, using the Beaufort wind scale.

- states lists the factors, other than the wind speed, which affect the appearance of the sea surface.
explains three differences between apparent and true wind

determines the true wind velocity by using a vector diagram, given the apparent wind and the ship's course and speed

describes the method of estimating the wind direction from the appearance of the sea surface

demonstrates the use of a geostrophic wind scale

1.1.7.5  Cloud and Precipitation (4 hours)

explains states that clouds form when air containing water vapour rises, cools adiabatically and becomes saturated

states describes the need for and defines condensation nuclei

states that a cloud can consist of ice crystals, supercooled water droplets, water droplets or any combination of these

names lists and describes the ten basic cloud types

states describes the probable base heights of the ten principal cloud types

defines 'precipitation'

defines 'rain', 'drizzle', 'hail', 'snow' and 'sleet'

1.1.7.6  Visibility (5 hours)

states that visibility is reduced by the presence of particles in the atmosphere, near the earth's surface

defines 'fog', 'mist', 'haze'

applies the concept of processes leading to supersaturation to a classification of fogs as mixing, cooling or evaporation fogs

explains qualitatively the formation of radiation fog, mentioning areas, seasons and reasons for its dispersal

states describes the effect of pollution on the formation of radiation fog

explains qualitatively the formation of advection fog, mentioning areas, seasons and reasons for dispersal
- explains qualitatively the conditions leading to the formation of sea smoke, and typical areas where sea smoke may be encountered
- describes methods of estimating the visibility at sea, by day and by night, and the difficulties involved

1.1.7.7 The Wind and Pressure Systems over the Oceans (10 hours)
- explains qualitatively, with the aid of sketches, the circulation cells which would exist on a rotating earth, not inclined to its orbit of rotation around the sun, and with a homogeneous surface
- draws the mean surface pressure and wind distribution over the earth’s surface in January and July
- describes the characteristics and location of the doldrums, intertropical convergence zone, trade winds, sub-tropical oceanic highs, westerlies and polar easterlies
- describes a monsoon regime
- states lists the areas which experience a true monsoon regime
- applies previous concepts to a qualitative explanation of the causes of monsoon regimes
- applies previous concepts to a qualitative explanation of the weather associated with the January and July monsoons of the Indian Ocean, China Sea, north coast of Australia and west coast of Africa
- explains qualitatively the monsoon-type weather along the north-east coast of Brazil
- applies the concept of horizontal temperature differences to a qualitative explanation of the formation of land and sea breezes
- explains the formation of anabatic and katabatic winds
- states lists the regions of occurrence of anabatic and katabatic winds
- states provides examples of local winds

1.1.7.8 Structure of Depressions (12 hours)
- defines ‘air mass’
- explains the formation of an air mass
- defines ‘source region’
- describes explains the characteristics required of a source region
- describes the source-region characteristics of arctic, polar, tropical and equatorial air-mass types
- defines 'warm front', 'cold front'
- knows the symbols for warm and cold fronts and identifies them on a weather map
- describes, with the aid of a diagram, the weather experienced during the passage of an idealized warm front
- describes, with the aid of a diagram, the weather experienced during the passage of an idealized cold front
- defines 'depression'
- identifies a depression on a surface synoptic or prognostic chart
- describes the stages in the life cycle of a polar front depression
- describes a family of depressions
- draws a diagram of a polar front depression, for both northern and southern hemispheres, showing isobars, warm and cold fronts, wind circulation and warm sector
- draws a cross-section through a polar front depression, on the poleward and equatorial side of the centre, showing fronts, cloud and precipitation areas
- describes the usual movement of a polar front depression
- applies previous concepts to an explanation of the weather changes experienced when a frontal depression passes with its centre on the poleward side of an observer in the northern hemisphere and in the southern hemisphere
- describes the process leading to the occlusion of a polar front depression
- identifies a trough of low pressure on a surface synoptic or prognostic chart
- describes the weather associated with the passage of a trough

1.1.7.9 Anticyclones and Other Pressure Systems (6 hours)
- defines 'anticyclone'
- draws a synoptic pattern of an anticyclone, for both northern and southern hemispheres, showing isobars and wind circulation
- identifies an anticyclone on a surface synoptic or prognostic chart
- describes the weather associated with anticyclones
- defines describes a ridge of high pressure
- draws a synoptic pattern for a ridge, showing isobars and wind directions
- describes a typical weather sequence during the passage of a ridge between depressions across the observer's position
- defines describes a col
- draws a synoptic pattern for a col, showing isobars and wind directions
- describes the weather associated with a col
- identifies ridges and cols on a surface synoptic or prognostic chart

1.1.7.10 Weather Services for Shipping (5 hours)
- describes the organization, functions and objectives of the World Meteorological Organisation
- describes the sources of weather information available to shipping including internet and email
- describes the information flow between merchant ships and Meteorological Offices
- describes the services provided for shipping by Meteorological Offices
- describes the appropriate weather bulletin and the contents of each of its sections
- describes the types of information received by facsimile machine
- describes the services provided for storm warnings

7.10 Recording and Reporting Weather Observations (6 hours)
- explains the need for meteorological codes
- uses the Ship's Code and Decode Book to code a ship's full report
- uses the Ship's Code and Decode Book to decode a ship's full report
- uses the Ship's Code and Decode Book to decode a reduced report from a shore station
- uses Beaufort letter abbreviations for present and past weather and total cloud amount
- interprets a ship or shore station plot

1.1.7.11 Weather Forecasting (10 hours)

- applies previous concepts to the interpretation of symbols and isobaric patterns on weather charts and facsimile charts
- applies previous concepts to the interpretation of synoptic and prognostic charts to ascertain wind directions, areas of strong winds, cloud and precipitation areas, fog areas, ice, and areas of fine weather
- explains how weather observations at a ship can be used to improve the forecast derived from synoptic and prognostic charts
- evaluates the weather forecast information received from internet and email
1.2 MAINTAINING A SAFE NAVIGATIONAL WATCH

TRAINING OUTCOMES:
Demonstrate a knowledge and understanding of:

1.2.1 KNOWLEDGE OF THE COLLISIONS REGULATIONS
1.2.2 PRINCIPLES IN KEEPING A NAVIGATIONAL WATCH
1.2.3 BRIDGE RESOURCE MANAGEMENT
1.2.4 THE USE OF ROUTENING

1.2.1 KNOWLEDGE OF THE COLLISION REGULATIONS
Textbooks: T8, T24, T31, T42, T48, T57
Training aids: A1, A37, V3

Required Performance:
1.2.1.1 The Content, Application and Intent of COLREG 72 (100 hours)

- explains the application of the rules as set out in Rule 1
- defines the term 'traffic separation scheme'
- states describes the responsibility to comply with the rules as set out in Rule 2
- describes and cites examples of precautions which may be required by the ordinary practice of seamen or by the special circumstances of the case
- gives examples of circumstances which may make a departure from the rules necessary
- states describes the general definitions which apply throughout the rules
- explains the term 'vessel constrained by her draught'
- distinguishes between 'under way' and 'making way'
- explains 'a proper look-out' and interprets the intent of 'full appraisal of the situation and the risk of collision'
- explains the use of radar in the context of Rule 5
  - explains what is meant by a safe speed
  - describes, with reference to court cases, how 'proper and effective action' and 'within a distance appropriate to the prevailing circumstances and conditions' may be interpreted
  - states describes the factors to be taken into account in determining a safe speed
  - explains how the use of radar affects the determination of safe speed
explains what is meant by risk of collision
  - describes the proper use of radar equipment in determining whether a risk of collision exists
  - explains the dangers of making assumptions on the basis of scanty information, citing examples from clear weather as well as the use of radar
  - illustrates, using examples from court cases, how failure to plot may lead to a lack of appreciation of a developing situation
  - illustrates, using examples from court decisions, the following actions to avoid collision referred to in Rule 8
    - positive action in ample time large enough to be readily apparent
    - alteration of course alone
    - passing at a safe distance
    - checking the effectiveness of action taken
    - reduction of speed
    - taking all way off
  - demonstrates an understanding of Rule 9 by:
    - defining the terms 'narrow channel' and 'fairway'
    - describing how to proceed along the course of a narrow channel
    - describing the navigation of small craft and sailing vessels in a narrow channel
    - stating the restrictions on crossing the channel or fairway describing the conduct of vessels engaged in fishing
    - stating the procedure for overtaking in a narrow channel
    - describing the actions to be taken on nearing a bend in a narrow channel or fairway
  - defines 'traffic lane', 'separation line', 'separation zone', 'inshore traffic zone'
  - describes how to navigate in a traffic separation scheme with reference to:
    - entering and leaving the traffic separation scheme
    - entering and leaving traffic lane
- crossing lanes
- the use of inshore traffic zones
- crossing separation lines or entering separation zones other than when crossing, joining or leaving a lane

- states describes the requirements for vessels:
  - navigating in areas near the terminations of traffic separation schemes
  - anchoring
  - not using a traffic separation scheme
  - engaged in fishing

- states that a vessel of less than 20 metres in length or a sailing vessel must not impede the safe passage of a power-driven vessel following a traffic lane

- states that the exemptions for vessels restricted in their ability to manoeuvre when engaged in an operation for the
  - maintenance of safety of navigation
  - laying, servicing or picking up of a submarine cable

- explains the meaning of 'precautionary area'
- defines 'deep water route' and describes for whom such a route is intended
- explains what is meant by 'vessels in sight of one another'
- demonstrates, with the use of models displaying proper signals or lights, a navigation light simulator or otherwise, the proper action to take to avoid collision with other vessels in sight
- explains how to decide when a vessel is an overtaking vessel
- compares and analyses the various avoiding actions which may be taken by an overtaking vessel
- explains the application of Rule 14, Head-on Situation
- explains why the give-way vessel in a crossing situation shall, if the circumstances admit, avoid crossing ahead of the other vessel
- explains the application of Rule 15 when crossing narrow channels and traffic lanes
- explains how Rule 16 and Rule 8 relate regarding the action by a give-way vessel
- explains the position of stand-on vessel in cases where a risk of collision exists between more than two vessels
- explains how to decide when to take avoiding action as stand-on vessel
- describes the actions which may be taken by the stand-on vessel
states describes the avoiding action which must be taken by the stand-on vessel

- explains states that a potential collision situation may be divided into the following four stages:
  - at long range, before risk of collision exists and both vessels are free to take any action
  - risk of collision applies, the give-way vessel is required to take action and the other vessel must keep her course and speed
  - the give-way vessel is not taking appropriate action
  - collision cannot be avoided by the action of the give-way vessel alone

- explains the responsibilities between vessels with reference to Rules 18 and 3
- explains the application of Rule 19
- compares Rule 6 and Rule 19 regarding the determination of safe speed
- explains how courts have interpreted 'a close-quarters situation'
- explains how courts have interpreted 'navigate with extreme caution'
- demonstrates, using a manoeuvring board or radar simulator, how to determine risk of collision and the proper action to take to avoid collision in restricted visibility
- states describes the application of the rules concerning Lights and shape

- states explains the definitions in Rule 21
- states describes the visibility of lights as prescribed by Rule 22
- identifies the lights and shapes carried by any type of vessel and the operation or circumstances signified by them, including the additional signals for fishing vessels fishing in close proximity
- describes the positioning, spacing and screening of lights
- describes the shapes required by the rules
- describes the sound signals to be used by vessels in sight of one another
- describes the sound signals to be used by vessels in or near an area of restricted visibility
- describes the use of signals to attract attention
- lists the distress signals set out in Annex IV of COLREG 72
1.2.2 PRINCIPLES IN KEEPING A NAVIGATIONAL WATCH

Training Outcome
Demonstrates a knowledge and understanding of:

1.2.2 The Principles in Keeping a Navigational Watch
Textbooks: T8, T24, T31, T42, T48, T57
Training aids: A1, A37, V4

Required Performance:

1.2.2.1 Keeping a Safe Navigational Watch (6 hours)

- states that the officer of the watch is responsible for navigating safely, with particular regard to avoiding collision and stranding

- describes the principles to be observed in keeping a navigational watch asset out in regulation A-VIII li/4 of STCW, 1978 regarding:
  - navigation
  - navigational equipment
  - navigational duties and responsibilities
  - handing over and taking over the watch
  - look-out
  - navigation with a pilot embarked
  - protection of the marine environment
  - Bridge Navigation Watch Alarm System
  - Blind pilotage technique
  - General principles for ship reporting systems and with VTS procedures

- describes the recommendation on operational guidance for officers in charge of a navigational watch contained in Section B-VIII/2 Chapter VIII, Section A-VIII/2 of the International Conference on Training and Certification of Seafarers, 1978:
  - maintenance of an efficient look-out
  - the use of engines and sound signalling apparatus
  - taking over the navigational watch
  - periodic checks of navigational equipment
  - compliance with SOLAS V/19 regarding the use of the automatic pilot and the change-over to manual steering and vice-versa
  - electronic navigational aids
  - the use of radar
  - navigation in coastal waters
  - conduct of the watch in clear weather
  - actions to take in restricted visibility
  - the circumstances in which the officer of the watch should call the master
- navigation with a pilot embarked
- briefing of watchkeeping personnel

- describes the duties of the officer of the watch while at anchor

- lists the entries which should be made in the log-book

### 1.2.2.2 Keeping a Watch in Port (4 hours)

*Keeping an Effective Deck Watch in Port under Normal Circumstances (2 hours)*

- states that arrangements for keeping watch in port should:
  - ensure the safety of life, ship, cargo and port
  - observe international, national and local rules
  - maintain order and the normal routine of the ship

- describes taking over the watch and lists the information which the officer being relieved should pass to the relieving officer

- lists the matters on which the relieving officer should satisfy themselves before assuming charge of the watch

- describes how the watch should be kept and lists the points to which attention should be paid

- describes the actions to take on receiving a storm warning or in an emergency threatening the safety of the ship

- lists the entries which should be made in the log-book

*Keeping a Safe Deck Watch in Port When Carrying Hazardous Cargo (2 hours)*

- defines 'hazardous cargo'

- states that sufficient personnel should be readily available on board when carrying hazardous cargo in bulk

- explains states that special requirements may be necessary for special types of ships or cargo, particularly with respect to:
  - the number of crew required on board
  - the state of readiness of fire-fighting appliances and other safety equipment
  - special port regulations
  -- communications with the shore in the event of an emergency arising
  -- special precautions to prevent pollution of the environment
- explains states that the officer of the watch should be aware of the nature of the hazards and any special precautions necessary for the safe handling of cargo
- states that the officer of the watch should be aware of the appropriate action in the event of a spillage or fire
- describes the procedure for entry into enclosed spaces using a 'permit to work', and the monitoring of work in progress
- describes the arrangements and procedures for rescue from an enclosed space in an emergency

1.2.3 EFFECTIVE BRIDGE TEAMWORK PROCEDURES

BRIDGE RESOURCE MANAGEMENT

Training Outcome

Demonstrates a knowledge and understanding of:

1.2.3 The Basic Principles of Bridge Resource Management

Textbooks: T24, T57
Teaching aids: A37, V4

Required performance:

1.2.3.1 Bridge Teamwork Procedures Resource Management (8 hours)

Note that this section is intended to ensure that trainees can apply the generic leadership, teamwork and resource management competence developed in Function 3 to the bridge environment.

- describes the basic principles of bridge teamwork resource management
  1 states that the conduct, handover and relief of the watch, must conform with principles and procedures
  2 states that a proper lookout is maintained at all times and in such a way as to conform with accepted principles and procedures
  3 consistently recognises lights, shapes and sound signals in the International Regulations for Preventing Collision at Sea
4 states that the frequency and extent of monitoring of traffic, the ship and the environment conform with accepted principles and procedures.

5 states that a proper record is to be maintained of the movements and activities relating to the safe navigation of the ship.

- explains how responsibility for the safety is clearly defined at all times, including periods when the master is on the bridge and while under pilotage.

6 states that decisions to amend course and/or speed are both timely and in accordance with accepted navigation practice.

7 states that adjustments made to the ship's course and speed maintain safety of navigation.

- demonstrates clear, concise communications and acknowledgements (at all times) in a seaman-like manner.

8 states that manoeuvring signals are made at the appropriate time and are in accordance with the International Regulations for Preventing Collision at Sea.

- demonstrates the allocation, assignment and prioritisation of resources.

- demonstrates the importance of ensuring the effectiveness of communication between bridge team members.

- explains the importance of ensuring the effectiveness of information exchange with pilot.

- demonstrates effective information exchange.

- defines "situational leadership".

- explains the relationship between assertiveness and leadership.

- explains the importance of challenge and response.

- explains the importance of obtaining and maintaining situational awareness.

- demonstrates appropriate challenges and responses.

- demonstrates the ability to maintain situational awareness in complex situations.
1.2.4 THE USE OF ROUTEING

Training Outcome

Demonstrates a knowledge and understanding of:

1.2.4.1 Weather routeing
1.2.4.2 Use of weather routeing

Textbooks: T48, T61
Teaching aids: -

Required Performance:

1.2.4.1 Weather Routeing (2 hours)

- explains the basic routines of weather routeing
- demonstrates the use of climatological information from routeing charts and sailing directions for route planning
- explains how meteorological forecasts, and synoptic and forecast charts are used to modify the route plan to utilise favourable conditions and mitigate adverse conditions
- explains states that with shore based services:
  - comprehensive meteorological information is available to personnel ashore who issue advice as to route planning and monitor the vessel's voyage, issuing forecasts and advice as to the utilisation of favourable conditions and mitigation of unfavourable conditions
- understands states that comprehensive meteorological information and on board software may be available to the Master who plans the route and then monitors the vessel's voyage and uses forecasts and warnings to utilise favourable conditions and mitigate the effects of unfavourable conditions
- states that when the ship is weather routed messages are received from the routeing service which may warn of adverse conditions (to be expected) and that these must be brought to the attention of the Master
1.2.4.2 Use of routeing in accordance with general provisions on ships' routeing (2 hours)  

- uses published routing instructions in passage planning

1.3 RADAR NAVIGATION AND ARPA  

R1, R33

NOTE: Training and assessment in the use of ARPA is not required for officers who serve exclusively on ships not fitted with ARPA. This Table A-II/1 limitation shall be reflected in the endorsement issued to the officer concerned

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

1.3.1. Knowledge of the fundamentals of Radar & Automatic Radar Plotting Aids (ARPA)

1.3.2. Ability to operate, and to interpret and analyse information obtained from radar, including the following:

- performance including:
  - factors affecting performance and accuracy
  - setting up and maintaining displays
  - detection of misrepresentation of information, false echoes, sea return etc., racons and sarts

- use including:
  - Range and bearing, course and speed of other ships, time and distance of closest approach of crossing, meeting and overtaking ships
  - Identification of critical echoes, detecting course and speed changes of other ships, effect of changes in own ship's course or speed or both
  - Application of the International Regulators for preventing collisions at sea
  - Plotting techniques, relative and true motion concept
  - Parallel indexing

1.3.3. Principle types of ARPA, their display characteristics, performance standards and the dangers of over-reliance on ARPA
1.3.4. Ability to operate and to interpret and analyse information obtained from ARPA including:

- System performance and accuracy, tracking capabilities and limitations and processing delays
- Use of Operational warnings and system tests
- Methods of target acquisition and their limitations
- True and relative vectors, graphic representation of target information and danger areas
- Deriving and analysing information, critical echoes, exclusion areas and trial manoeuvres

Required performance:

As per IMO Model Course 1.07, for Radar Navigation – Operational level

Also note that trainees should complete IMO Model Course 1.34, Operational Use of AIS in conjunction with syllabi items 1.3 and 1.4
1.4 ECDIS

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of ECDIS (40 hours)

Trainees should complete the training outlines in IMO Model Course 1.27. This includes:

- describes principle types of Electronic Chart System
- describes the differences between Vector and Raster Charts
- describes the terms and definitions used in the context of ECDIS
- explains the major characteristics of ECDIS data such as data term and definition; data contents; data structure; attribute; data quality and its accuracy
- describes the position reference system
- describes ECDIS display characteristics
- explains the scope and selection of chart data display categories
- explains the safety value available in ECDIS
- describes the automatic and manual functions of ECDIS
- explains various sensors, its accuracy requirement and state proper action to take in case malfunction
- describes the production and distribution of updates-manual, semi-automatic and automatic updating
- describes the route planning and route monitoring in ECDIS
- describes the route planning information; route planning calculation; calculation the voyage schedule; construction of a route; planned route checking for navigator safety; alternative route; optimization of route planning and ultimate route selection
- explains route and voyage monitoring; check route measurement and calculations; navigation in open sea, coastal and confined waters using ECDIS; current and wind effects
demonstrates the uses of all specific functions and obtain all relevant information for route planning and monitoring for navigating and for the ship's safety:

- sea area selection,
- route planning information,
- construction of a route,
- adjustment of a planned route,
- curve track planning,
- planning notes,
- safety values,
- check for navigational safety,
- Ultimate route, monitored area,
- vector time,
- check measurements,
- alarms,
- current and wind.

- explains the meaning of Status Indications, Indicators and Alarm relating to ECDIS
- explains the typical errors of interpretation and take proper action to avoid these errors
- explains the meaning of voyage recording, operate the corresponding functions and the reconstruction of past track
- describes the possible risk of over-reliance and complacency on ECDIS.

Required performance:

As per IMO Model Course 1.27, ECDIS
1.5 RESPOND TO EMERGENCIES

Training Outcome

Demonstrates a knowledge and understanding of:

1.5.1.1 4.4.1 PRECAUTIONS FOR PROTECTION AND SAFETY OF PASSENGERS

Textbooks: T36
Teaching aids: A1, A37, V9

Required Performance:

1.5.1.1 Contingency Plans for Response to Emergencies (8 hours) R1, R2

- lists the contents of a muster list and emergency instructions

- states that duties are assigned for the operation of remote controls such as:
  - main engine stop
  - ventilation stops
  - lubricating and fuel oil transfer pump stops
  - dump valves
  - CO2 discharge
  - watertight doors
  and operation of essential services such as:
    - emergency generator and switchboard
    - emergency fire and bilge pumps

- describes the division of the crew into a command team, all emergency team, a back-up emergency team and an engine-room emergency team

- explains the composition of emergency teams

- states that crew members not assigned to emergency teams would prepare survival craft, render first aid, assemble passengers and generally assist the emergency parties as directed

- states that the engine-room emergency team would take control of ER emergencies and keep the command team informed

- states that good communications between the command team and the emergency teams are essential
- describes the actions to take to deal with:
  - fire in specific areas such as galley, accommodation, engine-room or cargo space, including co-ordination with shore facilities in port, taking account of the ship's fire-control plan
  - rescue of victims of a gassing accident in an enclosed space
  - heavy weather damage, with particular reference to hatches, ventilators and the security of deck cargo
  - rescue of survivors from another ship or the sea
  - leakages and spills of dangerous cargo
  - stranding
  - abandoning ship

- explains the importance of drills and practices

1.5.1.2 Protection and Safety of Passengers (1 hour)

- states that some crew members will be assigned specific duties for the mustering and control of passengers lists the duties as:
  - warning the passengers
  - ensuring that all passengers spaces are evacuated
  - guiding passengers to muster stations
  - maintaining discipline in passageways, stairs and doorways
  - checking that passengers are suitably clothed and that life jackets are correctly donned
  - taking a roll-call of passengers
  - instructing passengers on the procedure for boarding survival craft or jumping into the sea
  - directing them to embarkation stations
  - instructing passengers during drills
  - ensuring that a supply of blankets is taken to the survival craft

1.5.2 INITIAL ACTION FOLLOWING COLLISION OR GROUNDING

Training Outcome

Demonstrates a knowledge and understanding of:

1.5.2.1 1.4.2.1 Precautions to be taken when beaching
1.5.2.2 1.4.2.2 Actions to be taken on stranding
1.5.2.3 – 5 1.4.2.3–5 Actions to be taken following other emergency situations, i.e. collision, fire etc
1.5.2.6 1.4.2.6 Auxiliary steering gear and operations

Textbooks: T10, T28
Teaching aids: A1

Required performance:

1.5.2.1 Precautions to be Taken When Beaching a Vessel (1 hour)  R1, R2

- describes the circumstances in which a vessel may be beached
- states that a gently shelving beach of mud, sand or gravel should be chosen if possible
- explains why beaching should be at slow speed
- states that wind or tide along the shore will quickly swing the ship broadside on to the beach
- describes measures which can be taken to prevent the ship driving further ashore and to assist with subsequent refloating
- states that all tanks and compartments should be sounded and an assessment made of damage to the ship
- states that soundings should be taken to establish the depth of water round the ship and the nature of the bottom

1.5.2.2 Actions to be Taken on Stranding (1 hour)  R1, R2

- states that, on stranding, the engines should be stopped, watertight doors closed, the general alarm sounded and, if on a falling tide, the engines should be put full astern to see if the ship will immediately refloat
- states that the engineers should be warned to change to high-level water intakes
- states that a distress or urgency signal should be transmitted and survival craft prepared if necessary
- states that all tanks and compartments should be sounded and the ship inspected for damage
- states that soundings should be taken to establish the depth of water round the ship and the nature of the bottom
- describes measures which can be taken to prevent further damage to the ship and to assist with subsequent refloating
- explains how ballast or other weights may be moved, taken on or discharged to assist refloating
- describes the use of ground tackle for hauling off
- describes ways in which tugs may be used to assist in refloating
- describes the use of the main engine in attempting to refloat and the danger of building up silt from its use

1.5.2.3 Actions to be Taken Following a Collision (1 hour) R1, R2
- states that after impact the engines should be stopped, all watertight doors closed, the general alarm sounded and the crew informed of the situation
- states that in calm weather the colliding ship should generally remain embedded to allow the other ship time to assess the damage or prepare to abandon ship
- states that survival craft should be made ready for abandoning ship or assisting the crew of the other ship
- states that damage to own ship should be determined
- states that a distress or an urgency signal should be made, as appropriate
- states that, if not in danger, own ship should stand by to render assistance to the other for as long as necessary
- describes measures to attempt to limit damage to salve own ship
- states that all details of the collision and subsequent actions should be entered in the log-book

1.5.2.4 Means of Limiting Damage and Salving the Ship Following a Fire or Explosion (2 hours) R1, R2
- describes methods of fighting fires (see Function 3.3, Prevent, Control and Fight Fires on Board)
- states that cooling of compartment boundaries where fire has occurred should be continued until ambient temperature is approached
- explains why it is important to drain spaces and pump out water resulting from fire fighting as quickly as possible
- states that a watch for re-ignition should be maintained until the area is cold
- states that no person should enter a compartment where a fire has been extinguished without breathing apparatus until it has been thoroughly ventilated

- describes the inspection for fire damage

- describes the safety measures to be observed when carrying out a fire damage inspection

- describes measures which may be taken to plug holes, shore up damaged or stressed structure, blank broken piping, make safe damaged electrical cables and limit ingress of water through a damaged deck or superstructure

- outlines the measures to be taken when the inert gas main and gas lines to a mast riser are fractured

- states that continuous watch should be kept on the damaged area and temporary repairs

1.5.2.5 Procedure for Abandoning Ship (2 hours) R1, R2

- states that a ship should only be abandoned when imminent danger of sinking, breaking up, fire or explosion exists or other circumstances make remaining on board impossible

- states that a distress call should be transmitted by all available means until acknowledged

- lists the information to include in the distress message

- describes other distress signals which may be used to attract attention

- states that extra food and blankets should be placed in boats when time allows

- states that the emergency radio should be placed in a survival craft to which a radio officer, where one is carried, is assigned.

- states that warm clothing and life jackets should be worn

- describes the launching of boats including free fall lifeboats and life rafts when the ship is listing heavily

- describes the launching of boats including free fall lifeboats and life rafts in heavy weather

- describes the on load release system of davit launched boats
describes the use of oil to calm the sea surface and explains why fuel oil is not suitable

states that the lifeboats with motors should be used to tow craft clear of ship, pick up survivors from the water and marshal survival craft

states that survival craft should remain together in the vicinity of the sinking ship to aid detection and rescue

describes the use of rocket line-throwing appliances and breeches buoy

1.5.2.6 Use of Auxiliary Steering Gear and the Rigging and Use of Jury Steering Arrangements (1 hour) R1, R2

describes typical arrangements of auxiliary steering gear

describes how the auxiliary steering gear is brought into action

describes how to change from bridge control to local control in the steering gear compartment

describes methods of securing the rudder in the event of a broken rudder stock

explains states that, in the event of the loss of the rudder, jury steering may be achieved by providing a drag on either side of the ship

describes a jury steering arrangement using materials normally found aboard ship

describes a means of constructing a jury rudder, where practicable

1.5.3 1.4.3 RESCUING PERSONS FROM THE SEA, ASSISTING A SHIP IN DISTRESS AND PORT EMERGENCIES

Training Outcome

Demonstrates a knowledge and understanding of:

1.5.3.1 1.4.3.1 Rescue of a person from a distressed vessel
1.5.3.2 1.4.3.2 Actions during emergencies in port
1.5.3.3 1.4.3.3 Measures for assisting vessel in distress
Textbooks: T10, T28, T29
Training aids: A1, A37, V7

Required performance:

1.5.3.1 Rescue of Persons from a Vessel in Distress or from a Wreck (2 hours)  

- states that it is preferable to wait for daylight when no immediate danger exists
- states that rescue boats or motor-lifeboats would be used if conditions permitted
- states that unnecessary equipment should be removed from the boats and be replaced by life jackets, lifebuoys, immersion suits, blankets and a portable VHF radio
- describes how both ships can spread oil in rough weather
- describes the preparations for taking survivors on board from the boats
- describes how to provide a lee and launch boats
- describes how boats should approach the wreck and pick up survivors
- describes the methods of recovery of boats and survivors
- describes methods of rescue which may be used when sea conditions are too dangerous to use boats

3.2 Actions which can be Taken When Emergencies Arise in Port  

(1 hour)

- describes actions to take in the event of fire on own ship, with particular reference to co-operation with shore facilities
- states that a duplicate set of fire control plans is stored for the assistance of shore-side fire-fighting personnel
- describes actions to be taken when fire occurs on a nearby ship or adjacent port facility
- lists situations in which a ship should put to sea for reasons of safety
- describes the actions which can be taken to avoid a ship dragging anchor towards own ship in an anchorage

3.3.1 Measures for Assisting a Vessel in Distress (1 hour) R1, R2

- states that both vessels should have everything prepared and have agreed on communications before the arrival of the towing ship

- describes how to approach a disabled vessel and pass the first connection by line-throwing apparatus or other methods

- states that the tow normally passes a messenger, followed by a wire messenger, to the towing vessel to haul across the towing wire

- describes how to payout the towing wire under control

- describes methods of securing the towing wire at the towing ship

- explains why the wire is usually shackled to the anchor cable at the tow

- describes the preparations made by the disabled ship

- states that the towing wire should be protected from chafing at fairleads

- states that wires and cables should be inspected frequently and the nip freshened if any sign of wear or chafe is found

- states that the towed vessel should be steered to reduce yawing

- states that both ships should remain alert for signals from other vessel

- describes how to disconnect the tow on arrival at the destination

- describes the arrangements for emergency towing of tankers greater than 50,000 tonnes deadweight

- lists the information to be transmitted to the towing ship
1.6 1.5.1 RESPOND TO A DISTRESS SIGNAL AT SEA

TRAINING OUTCOME

Demonstrates a knowledge and understanding of:

1.6.1 1.5.4 SEARCH AND RESCUE  
R1, R2, R2O

Textbooks: T45  
Teaching aids: A1, A37, V6

Required performance:

1.6.1.1 Search and Rescue (2 Hours)

The content and application of the IMO Merchant Ship Search and Rescue Manual (MERSAR) and the International Aeronautical and Maritime Search and Rescue (IAMSAR) Vol III

1.7 USE THE IMO STANDARD MARINE COMMUNICATIONS PHRASES AND USE ENGLISH IN WRITTEN AND ORAL FORM THE ENGLISH LANGUAGE

TRAINING OUTCOMES

Demonstrates a knowledge and understanding of:

1.7.1 1.6.1 THE ENGLISH LANGUAGE

(SEE IMO MODEL COURSE 3.17, MARITIME ENGLISH)


1.7.2 1.6.2 STANDARD MARINE NAVIGATIONAL VOCABULARY
**Textbooks:** T67
**Teaching aids:** A1, A38

Required performance:

1.7.1  **English Language**  
R1, R18

- use English in written and oral form to:
  - use charts and other nautical publications
  - understand meteorological information and messages concerning ship's safety and operation
  - communicate with other ships and coast stations
  - perform the officer's duties also with a multi-lingual crew

1.7.2  **Standard Marine Navigational Vocabulary Communication Phrases**

**Textbooks:** T68
**Teaching aids:** A1, A38

Required performance:

1.7.2.1  **Standard Marine Navigational Vocabulary Communication Phrases**

- use the Standard Marine Navigational Vocabulary, as replaced by the IMO Standard Marine Communication Phrases

1.8  **Transmit and Receive Information by Visual Signalling**

**Training Outcomes:**
Demonstrates a knowledge and understanding to:

1.8.1  1.7.1 Transmit and Receive Signals by Morse Light
1.8.2  1.7.2 Use the International Code of Signals

1.8.1 1.7.1 Transmit and Receive Signals by Morse Light

**Training aids:** A1

Required performance:

1.8.1.1. **Signalling by Morse code (10 hours)**
identifies Morse symbols for the alphabet and numerals

- sends and receives the distress signal SOS by flashing light at a rate of at least 15 characters per minute

- lists the parts of a signal made by flashing as:
  - the call
  - the identity
  - the text
  - the ending

- demonstrates the procedure for sending a message to an unknown ship in plain language or in code

- correctly uses the 'erase' signal when sending or receiving

- correctly uses the 'repeat' signal

- correctly uses the repetition signals AA, AB, WA, WB and BN

- explains the use of the waiting signal AS

- demonstrates the use of the procedure signals C, N (or NO), RQ and states that they cannot be used with single-letter signals

- states the meaning and explains the use of YU, YV, YZ

- states the recommendations on sound signalling

- lists the single-letter signals which may be sounded only in compliance with the requirements of the International Regulations for Preventing Collisions at Sea

- demonstrates sending and receiving Morse by hand, flags or arms

- states the distress signal when made by flashing light
1.8.2 1.7.2 USE THE INTERNATIONAL CODE OF SIGNALS

Training Outcome

Demonstrates a knowledge and understanding of:

1.8.2.1 1.7.2.1 International Code of Signals

Teaching aids: A1

Required performance:

1.8.2.1 International Code of Signals (10 hours)

- recognises all International Code flags and pendants
- explains the purpose of the International Code of Signals
- correctly uses substitute flags
- demonstrates how to call, using flags
- demonstrates the use of the answering pendant
- explains actions to take when signals are not understood
- **states describes** how the end of a signal is indicated
- states that names in the text of a signal are to be spelt out in plain language
- explains the use of identity signals
- states that, in flag signalling, the answering pendant is used to indicate the decimal point in numbers
- demonstrates how to signal azimuth or bearing, course, date, latitude, longitude, distance, speed, time
- describes the arrangement of the Code into:
  -- single-letter signals
  -- two-letter signals for the General Section
  -- three-letter signals beginning with 'M' for the Medical Section
- describes the use of complements and the tables of complements
- describes how to signal depths
- explains the significance of text in brackets
- states that cross-referencing of signals in the right-hand column is used to facilitate coding
- states describes the meanings of single-letter signals
- states that there are single-letter signals for use between an ice-breaker and assisted vessels
- explains states that how time of origin may be included codes and decodes messages, using the General Section codes and decodes messages, using the Medical Section and complements
- states describes the International Code Signal of distress

1.9 SHIP MANOEUVRING AND HANDLING

TRAINING OUTCOMES:

Demonstrate a knowledge and understanding of:

1.9.1 1.8.1 SHIP MANOEUVRING AND HANDLING

Textbooks: T2, T38, T53
Teaching aids: A1, A37, V7, V8

Required performance:

1.9.1.1 The Effects of Various Deadweights, Draughts, Trim, Speed and Under-Keel Clearance on Turning Circles and Stopping Distances (4 hours)

- outlines the provision and display of manoeuvring information recommended in Assembly resolution A.601(15)
- defines the terms:
  - advance
  - transfer
  - drift angle
  - tactical diameter
  - track reach
  - head reach
  - side reach
- compares the turning circles of a ship in the loaded and ballasted conditions
- compares turning circles for differing speeds

- explains the used of the Rate of Turn Indicator to assist turning of vessel

- describes the accelerating turn

- states that the size of the turning circle increases as the under-keel clearance reduces

- describes how speed reduces during a turn under steady engine power

- compares the stopping distances of a ship in the loaded and ballasted conditions

- explains why a loaded ship carries her way longer than when in ballast

- states that the stopping distance for a loaded ship may be up to three times the stopping distance when in ballast

- states that in shallow water a ship will carry her way longer than in deep water

- defines 'directional stability'

- describes the steering behaviour of directionally stable and unstable ships

1.9.1.2 Effect of Wind and Current on Ship Handling (2 hours)

- explains how states that the effect of wind on a given ship depends upon:
  -- the wind strength
  -- the relative direction of the wind
  -- the above-water area and profile
  -- the draught and trim
  -- the ship's fore-and-aft movement

- describes the behaviour of a ship moving ahead with a wind from various directions

- states that, as a ship is slowed, a speed is reached at which the wind prevents maintaining course

- describes the effect of wind when making large turns

- describes the effect of wind on a ship making sternway
- describes the effect of current on the motion of a ship
- states that in rivers and narrow channels the current is usually stronger in the centre of a straight channel or at the outside of bends
- describes how to make use of different current strengths when turning in a channel
- describes how a current may be used to control lateral movement towards or away from a river berth
- explains how to use an anchor to dredge down with a current
- demonstrates the ability to manoeuvre the vessel in simple turning and anchoring manoeuvres in various conditions

1.9.1.3 Manoeuvres for the Rescue of a Person Overboard (2 hours)
- distinguishes between "immediate action", "delayed action" and "person missing" situations
- describes the single turn, Williamson turn and Scharnow turn manoeuvres
- explains the situations in which each turn is appropriate
- explains states that the standard manoeuvres are not guaranteed to return a ship into its wake because of the effects of particular ship characteristics and environmental conditions on the ship and the person in the water
- lists the sequence of actions to take when a person is seen to fall overboard
- lists the actions to take when a man-overboard report is received on the bridge
- Demonstrates the ability to manoeuvre the vessel for the rescue of a person overboard

1.9.1.4 Squat, and Shallow-Water and Similar Effects (3 hours)
- defines states that shallow water as a depth of less than \( 1.5 \times \text{ship's draught} \)
- explains states that shallow-water effects become more marked as depth decreases
- lists states that shallow-water effects as:
  -- increased directional stability
  -- a large increase in turning radius
the ship carrying her way longer and responding slowly to changes in engine speed
-- speed falling less during turns
-- squat increasing
-- trim changing, usually by the head for a full hull form

- defines states that 'squat' is defined as the reduction of under-keel clearance resulting from bodily sinkage and change of trim which occurs when a ship moves through the water

- states that squat is considerably reduced by a reduction of speed

- defines states that 'blockage factor' as the ratio of the cross-sectional area of the ship to the cross-sectional area of water in a channel

- states that squat and other shallow-water effects increase as the blockage factor increases

- states that excessive speed in shallow-water can ground a ship in water of sufficient depth to float it at slow speed

- states that approaching shoal patches or banks may give rise to an unexpected sheer

- states that reduced speed should be used in shallow water and narrow channels to reduce shallow-water effects and allow time to correct an unwanted sheer

- states that increased vibration may be experienced in shallow water

1.9.1.5 Proper Procedures for Anchoring and Mooring (4 hours)

- describes how anchors should be cleared away ready for use

- describes how the approach to an anchorage is made with regard to current and wind

- states that anchors should be walked back clear of the hawse pipes when approaching the anchorage

- describes the use of anchor buoys

- describes the safety measures to be taken by the anchor party

- describes the method of letting go and the amount of cable to veer initially

- describes the marking of the cable and the reports to be made to the bridge

- explains how to determine when the ship is brought up
- states that the lights or shape for a vessel at anchor should be displayed as soon as the ship is brought up
- describes the procedures for anchoring in water too deep to let the anchor go on the brake
- describes the securing of anchors on the completion of anchoring
- describes the preparation for and procedure during heaving up
- explains how to handle cable safely in a non-self-stowing locker
- explains how to secure anchors and seal spurling pipes for a sea passage
- lists the preparations to be made for berthing alongside
- describes the use of head ropes, stern ropes, breast ropes and springs
- describes the safety measures to be taken when handling mooring ropes and wires
- describes how to join two mooring ropes together
- describes typical mooring arrangements
- demonstrates how to put a stopper on a rope or wire rope
- demonstrates how to make a mooring rope or wire fast to bitts
- describes the use of self-tensioning winches
- states the importance of keeping mooring lines clear of the propeller and notifying the bridge when the propeller is not clear
- describes how to make fast tugs on towing hawsers or lashed up alongside
- describes the use of fenders during berthing and when secured in position
- describes methods of mooring to a buoy
- explains how to use a messenger to pass a wire or chain to a buoy
- explains how to set up and secure a ship wire
- describes the method of securing ropes and wires to a buoy
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- describes the procedures for singling up and letting go from berths and buoys
- explains how to slip a slip wire
- describes how to stow mooring ropes and wires for a sea passage
- explains how to rig and light the pilot ladder
- states what equipment should be at hand ready for use at the pilot ladder
- states that the rigging of the ladder and the embarkation and disembarkation of the pilot should be supervised by a responsible officer
Function 2:

Cargo Handling and Stowage at the Operational Level
Function 2: Cargo Handling and Stowage at the Operational Level

Part B2: Course Outline and Guidance Notes

Timetable
No formal example of a timetable is included in this model course.

Development of a detailed timetable depends on the level of skills of the trainees entering the course and the amount of revision work of basic principles that may be required.

Lecturers must develop their own timetable depending on:

7 the level of skills of trainees
8 the numbers to be trained
9 the number of instructors

and normal practices at the training establishment.

Preparation and planning constitute an important factor which makes a major contribution to the effective presentation of any course of instruction.

Lectures
As far as possible, lectures should be presented within a familiar context and should make use of practical examples. They should be well illustrated with diagrams, photographs and charts where appropriate, and be related to matter learned during seagoing time.

An effective manner of presentation is to develop a technique of giving information and then reinforcing it. For example, first inform the trainees about the objectives of the subject to be covered and tell the trainees briefly what you are going to present to them; then cover the topic in detail; and, finally, summarize what you have told them. The use of an overhead projector and the distribution of copies of the transparencies as trainees handouts contribute to the learning process. For topics involving tanker operation, the use of a liquid cargo handling simulator would be encouraged to demonstrate the effect cargo operations on the ship.

Course Outline
The tables that follow list the competencies and areas of knowledge, understanding and proficiency, together with the estimated total hours required for lectures and practical exercises. Teaching staff should note that timings are suggestions only and should be adapted to suit individual groups of trainees depending on their experience, ability, equipment and staff available for training.

Competence 2.1 MONITOR THE LOADING, STOWAGE, SECURING AND UNLOADING CARGOES AND THEIR CARE DURING THE VOYAGE
Note for reviewers: few changes have been suggested in the required performance elements for the above, however, the time provisions in the current model course are inadequate. Note that the draught, trim and stability section has been increased to 10 hours but this is only realistic if trainees have previously completed the generic stability course requirements identified in function 3.

2.1.1 THE EFFECT OF CARGO, INCLUDING HEAVY LIFTS ON THE SEA-WORTHINESS AND STABILITY OF THE SHIP

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2.1.2 SAFE HANDLING, STOWAGE AND SECURING OF CARGOES

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2.2 INSPECT AND REPORT DEFECTS AND DAMAGE TO CARGO SPACES, HATCH COVERS AND BALLAST TANKS

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<td>Damage report</td>
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<td>Enhanced survey programme</td>
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Total for Function 2: Cargo Handling and Stowage at the Operational Level 62

Teaching staff should note that the hours for lectures and exercises are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adapted by lecturers to suit individual groups of trainees depending on their experience, ability, equipment and staff available for teaching.
Guidance Notes

The following notes are intended to highlight the main objectives or training outcomes of each part of the function. The notes also contain some material on topics which are not adequately covered in the quoted references.

Function 2: Cargo Handling and Stowage at the Operational level

On completion of training for this function, trainees will be able to use cargo plans and tables or diagrams of stability and trim data to calculate the ship's initial stability, draughts and trim for any given description of cargo and other weights. They will also be able to determine whether stresses on the ship are within permitted limits by the use of stress data or calculation equipment, or software.

The safety precautions before entering enclosed or potentially contaminated spaces will be understood.

Trainees should be able to supervise the preparation and dunnaging of holds and the operation of ships' cargo gear and will be aware of the importance of adequately securing cargo to prevent damage to the ship or cargo. Trainees will identify dangerous goods and know that they are stowed and separated according to requirements of the IMDG Code (R3, V4 and V5). They will also know the hazards related to some bulk cargoes and the precautions to take during their loading, carriage and discharge. Trainees will also have a basic knowledge of the piping and pumping arrangements of oil tankers.

2.1 MONITOR THE LOADING, STOWAGE, SECURING AND UNLOADING OF CARGOES AND THEIR CARE DURING THE VOYAGE

2.1.1 THE EFFECT OF CARGO, INCLUDING HEAVY LIFTS ON THE SEAWORTHINESS AND STABILITY OF THE SHIP (17 hours)

Securing cargoes

Trainees should be made aware that shifting cargo can cause serious structural damage in addition to producing a possibly dangerous list. Examples are ventilators sheared off by deck cargo and 'tween-decks collapsed by overloading as a result of cargo shifting from the other side of the ship.

Considerable damage will also be done to fragile cargo which is thrown about by the ship's movement.
Deck cargo
The general principles of stowing and securing deck cargo so that it does not interfere with the safe operation of the ship and permits safe access to accommodation and working spaces should be dealt with as well as the particular requirements for timber deck cargoes.

Container cargo
The planning of loading of a container ship is normally undertaken ashore, but the officer in charge of the watch should keep an eye on the loading to detect errors in stowage which may occur. A particular watch should be kept for containers with dangerous goods placards to see that their stowage satisfies segregation requirements.

Other things to watch for are that container marked for underdeck stowage do not end up on deck and that refrigerated containers are loaded where they can be connected to the ship's power supply (VB).

Finally, the officer in charge of the watch will check that the cargo is secured, using the correct fastenings, lashings or rods, and that they are set up as laid down in the ship's securing arrangements manual.

Bulk cargoes (other than grain)
The contents of the Code of Safe Practice for Solid Bulk Cargoes International Maritime Solid Bulk Cargo should be covered in sufficient depth to ensure that trainees know what information is available and how to find the necessary details for the safe carriage of a particular cargo.

The officer of the watch should know the pre-planned loading procedure regarding quantities to be loaded in each space, the order of deballasting tanks and shifting the vessel under loading chutes. The procedure will have been worked out to keep stresses within acceptable limits and to finish with a satisfactory weight distribution and trim. The officer of the watch should see that the plan is followed, particularly at berths with only one loading chute, to avoid over-stressing the ship (V9).

Bulk grain cargoes
Trainees should not be expected to know the details of the stability calculations for the issue of the document of authorization. They should be made aware that the calculations involve the depth of void spaces under decks, behind deck stringers and in hatchways of filled compartments. Efficient trimming is required to ensure that spaces are filled to the maximum possible extent so as to limit the void spaces to those used in the calculations. They should be able to supervise the construction of saucers or bundles for securing grain surfaces at hatchways and understand that satisfactory stability depends upon their being properly constructed.
Occasionally, different types of grain are loaded into the same hold. The denser grain is loaded first and trimmed level over the entire area of the hold. The surface is covered with separation cloths, allowing for ample overlaps. The cloths are carried well up the sides and ends of the compartment so that the next grain loaded will force them against the plating between the frames and stiffeners. The lighter grain should be loaded carefully at first to avoid displacing the separation cloths.

For bulk grain cargoes such as wheat, corn or any cargoes with a small angle of repose, the cleanliness of the holds is critical as any live insects or bugs could damage the cargo. For this reason, the holds are first swept to avoid the cargo residual from choking the bilges during hold washing. After the hold is washed, all loose rust and paint must be scrapped and removed as this would provide potential hiding places for insects. The holds are rinsed with fresh water. After the holds are dry, mild insecticide is sprayed and the hatches are closed. Ensure the holds are well ventilated before arrival at the port of loading.

2.1.2 CARGO HANDLING, STOWAGE AND SECURING OF CARGOES
(31 hours)

Publications contain guidance on safety of cargo equipment and safe working practices during cargo handling.

**Cargo Care**

**Inspection and preparation of holds**
This section deals with the cleaning, dunnaging and general preparation of holds for loading dry cargoes. When dealing with inspection of holds, it should be impressed upon trainees that they should look for damage, missing fixed dunnage or anything else untoward whenever they visit a cargo space during their watch. Any damage or deficiencies should be noted and reported to the master or chief mate. It is particularly important to watch out for damage to hatch coamings and covers, access ladders to cargo spaces and damaged or missing fencing. Attention should also be paid to guards on moving parts of machinery or steam pipes on deck.

**Segregation and separation of cargoes**
The segregation of dangerous goods is dealt with in topic area 3. The segregation covered in this section is mainly concerned with protecting cargo from damage by other cargoes. Certain dangerous goods may need segregation from other cargoes which are not themselves dangerous; for example, goods which become dangerous when wet should not be stowed where drainage from wet hides could affect them.

Methods of separation and port marking, to minimize over-carriage, should also be considered.

**Ventilation and control of sweat**
The methods of minimising the formation of sweat when only natural ventilation is available should be covered.
Refrigerated cargo
The cleanliness of cargo compartments for the transport of refrigerated foodstuffs is more important than for any other cargoes. Failure to clean properly can result in mould growth and rotting of fruit and vegetables. Spaces are swept down and all loose dirt removed. Any remaining residues of previous cargoes will have to be scraped or washed off. After cleaning, the spaces are sprayed with a mild disinfectant such as weak sodium hypochlorite solution, which also helps to remove odours. Alternatively, an ozoniser may be used for the same purpose, especially after the carriage of a strong-smelling cargo like oranges.

Holds and lockers are then cooled to carriage temperature. It is essential that any dunnage to be used is placed in the space before pre-cooling, since the use of warm dunnage could cause considerable damage. It is common practice to have holds and refrigerating machinery inspected by an independent surveyor to certify that the ship is in a fit condition for the carriage of the intended cargo.

The cargo should be inspected ashore by the ship's officers before loading to see that it is in good condition and has been properly pre-cooled where that is required. A sample of the cargo should be thoroughly inspected for signs of mould or other damage and its temperature checked by inserting a steel-tipped thermometer into the product. A record of the inspection and temperatures recorded should be kept. Similar random inspections of the cargo should be made during the loading. Any damaged products or carcasses which have thawed should be rejected or loaded separately. They could cause spoiling of the remainder of the cargo which was in good condition.

The carriage temperatures are stipulated by the shipper of the goods and should be adhered to as closely as possible. Temperatures are taken and recorded at frequent regular intervals and entered in a log-book. Many ships are also equipped with thermographs, which provide a continuous record of compartment temperatures. In the event of claims for cargo damage, the records and thermograph charts will be required as evidence that the correct temperatures were maintained.

In general cargo ships with a limited amount of refrigerated space it is usual to arrange, as far as possible, for the refrigerated cargo to be loaded last and at its destination to be discharged first (VB).

Dangerous, hazardous and harmful Cargoes
Trainees should be aware of the information contained in the IMDG Code and the classification of dangerous goods. They should also be able to identify the labelling and marking required by that Code.

The officer of the watch should have full details of any dangerous goods to be loaded or discharged, their stowage and the measures to be taken in the event of an incident. Trainees should know how to find the information on emergency procedures and first aid and be aware that such information should be known and any necessary equipment prepared for use before starting to handle the goods. They should also
have the same information regarding dangerous goods already on board which are not for discharge at that port.

Damaged packages should not be accepted but be returned ashore for checking and repacking. Any incident occurring during the handling of dangerous goods should be reported immediately to the senior officer in charge of the operation.

**Cargo-handling equipment and safety**

The rigging and operation of derrick cranes of the Hallen, Valle or similar types should be included in this section.

The frequent inspection of ropes, wires, blocks and other cargo gear in use is made by the officer in charge of the watch during his rounds of the deck. If there is doubt about the condition of any of the gear, work should be stopped so that a more thorough inspection can be made and a replacement provided if necessary.

When opening or closing steel hatch covers, a check wire should be used to prevent the covers taking charge, if that is possible. No one should stand or walk on unsecured hatches.

**Deep tank cargoes**

The cargoes which used to be carried in deep tanks are now frequently carried in chemical tankers but some cargoes, principally vegetable oils cargoes that do not need a complete separation of compartment from the hull, may still be carried in deep tanks of cargo vessels.

Carriage temperatures are laid down by the shippers and should be adhered to. They may require a higher temperature at discharging to ensure suitable viscosities for handling after allowing for some cooling in piping and pumping systems. The maximum rise in temperature per day may also be stipulated, making it necessary to raise the temperature to that required for discharging over several days. Too rapid heating can result in scorching the oil in contact with the heating coils and lead to claims for cargo damage. Tank temperatures should be taken and recorded at regular intervals.

**Oil Tanker Piping and Pumping Arrangements**

This section is intended to familiarize trainees with the general arrangement of oil tankers and their piping and pumping arrangements, to act as a foundation for further training in tanker procedures at the chief mate and master level. It is recommended that, if available, the use of a liquid cargo handling simulator as part of the training aids to provide realism for the trainees.

A detailed treatment of tanker operations is not required since those officers who are to serve in oil tankers will undertake specialized courses, including basic safety, pollution-prevention precautions and operational procedures (V6, V7)
Precautions before Entering Enclosed or Contaminated Spaces

It should be emphasized that collapse due to lack of oxygen can be very rapid, giving the victim no chance to clear out of the space. Similarly, a person can be overcome by toxic gases without realising that there is anything amiss (V10).

Measurements using the correct instruments must be made in a number of locations in the spaces to be entered if there is any possibility of a reduction in oxygen or the presence of toxic or flammable gases.

The sense of smell should never be relied upon; some gases are toxic at levels well below that at which they can be detected by smell; others, such as hydrogen sulphide, can temporarily destroy the sense of smell after the first breath. A lack of oxygen produces no smell.

Until a space has been thoroughly cleaned and ventilated there is a chance of the further production of dangerous levels of a toxic gas so periodic checks should be made while work is in progress and all the checks should be repeated before re-entry after an interval such as a meal break (T70).

Cargo calculations and cargo plans

The stowage factor, SF, of a cargo is the volume occupied by 1 tonne of the cargo. For a bulk liquid cargo it is the specific volume of the substance, i.e. the reciprocal of density.

With packaged goods, it may be impossible to fill the whole space due to the presence of pillars and ladders, curvature and flare of the sides of end holds or the height of 'tween-decks not suiting the package size. The resulting lost space is known as broken stowage and is usually expressed as a percentage of the total space. An average allowance, based on past experience, is included in the stowage factor.

Broken stowage must be taken into account when estimating the number of packages of given size which can be loaded into a space. For example, if an allowance for broken stowage of 15% is made, the available space for cargo is reduced to 85% of the total volume.

Deck loading

Details of the maximum permitted deck loadings may be supplied to the ship. They would normally be expressed in kg/m² or tonnes/m². When loading high-density cargo into a 'tweendeck, the height of cargo must be restricted to prevent overstressing the deck structure.
2.2 INSPECT AND REPORT DEFECTS AND DAMAGE TO CARGO SPACES, HATCH COVERS AND BALLAST TANKS (14 HOURS)

Cargo space inspection
Prior to commencement of loading, the cargo holds should therefore be
- inspected to ensure that they are clean, dry, free from smell, remnants of previous cargoes and insects
- checked for small holes and cracks in the steel work to adjacent tanks as leaks from ballast or bunker tanks can cause large scale damage/contamination

If deficiencies are found, it must be rectified immediately and a corresponding record made by completing the relevant maintenance or repair form.

Cargo space for dry bulk cargo are susceptible to damages due to the mode of loading and discharging, use of shore facilities to assist in loading and discharging, corrosion as well as damage due to severe weather condition.

Ship officers must carry out through inspection of the cargo space immediately after completion of discharging operation for dry bulk cargo space to detect any damages to the ship structure and report forwarded to the Chief Officer for further action.

Hatch covers inspection
The inspection of the vessel should include a special check on the condition of: Watertight doors, ventilation heads, hatch covers, hold access covers, dogs and clamps, side ports, ramps and doors to the superstructure and, the condition of the rubber gaskets.

Damaged, worn or compressed parts must be replaced immediately. Drainpipes and gutters on the hatch covers and panels also require attention and need to be kept clean at all times.

On the vessel with hatch covers, if the vessel’s cargo operations so allow, make a daylight test of the hatch covers to check whether they are tight. Hatch covers are the most vulnerable part of the vessel when it comes to water ingress during the voyage and can endanger the safety of both the vessel and the crew.

Hatch cover quick acting cleats should be in good working condition and rust free. Worn parts should be replaced.

Ballast tanks inspection
Due to the nature of trade and cargo carried, ballast tanks onboard are generally subjected various conditions of loading and discharging as well as sloshing effect or free surface effect. Even though the damage due to internal factor is minimal but due to the nature of its location which are generally next to the cargo space, the damage due to cargo operation must also take into consideration.
Another possible cause of damage for the ballast tanks is the corrosion where there existing of paint work defect.

**Damage report**

Damage to any part of the vessel may be caused by:

- stevedores during cargo operation
- shore terminal operators with cranes
- contractors during works
- truck drivers on ro-ro vessels

As in the case of any other damage it is important to collect the necessary evidence as soon and as complete as possible in order for the Company to be able to pursue the claim.

**Enhanced Survey Programme**

Reference to Guidelines on the Enhanced Programme of Inspections during Surveys of Bulk Carriers and Oil Tankers.
Part C2: Detailed Teaching Syllabus

Introduction

The detailed teaching syllabus is presented as a series of learning objectives. The objective, therefore, describes what the trainee must do to demonstrate that the specified knowledge or skill has been transferred.

Thus each training outcome is supported by a number of related performance elements in which the trainee is required to be proficient. The teaching syllabus shows the Required performance expected of the trainee in the tables that follow.

In order to assist the instructor, references are shown to indicate IMO references and publications, textbooks and teaching aids that instructors may wish to use in preparing and presenting their lessons.

The material listed in the course framework has been used to structure the detailed teaching syllabus; in particular,

- Teaching aids (indicated by A)
- IMO references (indicated by R) and
- Textbooks (indicated by T)

will provide valuable information to instructors.

Explanation of Information Contained in the Syllabus Tables

The information on each table is systematically organised in the following way. The line at the head of the table describes the FUNCTION with which the training is concerned. A function means a group of tasks, duties and responsibilities as specified in the STCW Code. It describes related activities which make up a professional discipline or traditional departmental responsibility on board.

In this Model course there are three functions:

Navigation at the Operational Level
Cargo Handling and Stowage at the Operational Level
Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level.

The header of the first column denotes the COMPETENCE concerned. Each function comprises a number of competences. For example, the Function 2, Cargo Handling and Stowage at the Operational Level, comprises a single COMPETENCE. Each competence is uniquely and consistently numbered in this model course.

In this function the competence is Monitor and Loading, Stowage and Securing and Unloading of Cargoes and their Care During the Voyage. It is numbered 2.1,
that is the first competence in Function 2. The term competence should be understood as the application of knowledge, understanding, proficiency, skills, experience for an individual to perform a task, duty or responsibility on board in a safe, efficient and timely manner.

Shown next is the required TRAINING OUTCOME. The training outcomes are the areas of knowledge, understanding and proficiency in which the trainee must be able to demonstrate knowledge and understanding. Each COMPETENCE comprises a number of training outcomes. For example the above competence comprises a total of two training outcomes. The first is in SEAWORTHINESS AND STABILITY OF THE SHIP. Each training outcome is uniquely and consistently numbered in this model course. That concerned with seaworthiness and stability is uniquely numbered 2.1.1. For clarity training outcomes are printed in black on grey, for example TRAINING OUTCOME.

Finally, each training outcome embodies a variable number of required performances - as evidence of competence. The instruction, training and learning should lead to the trainee meeting the specified required performance. For the training outcome concerned with seaworthiness and stability, there are six areas of performance. These are:

2.1.1.1 Draught, trim and stability (10 4 hours)

It should be noted that the required performance in cargo specific draught, trim and stability elements above should be completed after or in conjunction with the generic stability course requirements identified in function 3.

2.1.1.2 Securing cargoes (2 hours)
2.1.1.3 Deck cargo (4 hours)
2.1.1.4 Container cargo (2 hours)
2.1.1.5 Bulk cargo (3 hours)
2.1.1.6 Bulk grain cargo (2 hours)

For the training outcome concerned with safe handling, stowage and securing of cargoes, there are six areas of performance. These are:

2.1.2.1 Cargo care (9 hours)
2.1.2.2 Dangerous, hazardous and harmful cargoes (4 hours)
2.1.2.3 Cargo handling equipment and safety (7 hours)
2.1.2.4 Oil tanker piping and pumping arrangements (4 hours)
2.1.2.5 Precautions before entering enclosed or contaminated spaces (2 hours)
2.1.2.6 Cargo calculations and cargo plans (5 hours)

Following each numbered area of required performance there is a list of activities that the trainee should complete and which collectively specify the standard of competence that the trainee must meet. These are for the guidance of teachers and instructors in designing lessons, lectures, tests and exercises for use in the teaching.
process. For example, under the topic 2.1.1.1 Draught, trim and stability, to meet the required performance, the trainee should be able to:

10 define 'deadweight' and 'displacement tonnages'
11 sketch a ship's load line indicating marks for various seasonal zones, areas and periods
12 use a ship's hydrostatic particulars and give mean draughts to determine the approximate weight loaded or discharged use a deadweight scale to determine the change in mean draught resulting from loading or discharging a given tonnage and so on.

IMO references (Rx) are listed in the column to the right hand side. Teaching aids (Ax), videos (Vx) and textbooks (Tx) relevant to the training outcome and required performances are placed immediately following the TRAINING OUTCOME title.

It is not intended that lessons are organised to follow the sequence of required performances listed in the Tables. The syllabus tables are organised to match with the competence in the STCW Code Table A-II/1. Lessons and teaching should follow college practices. It is not necessary, for example, for celestial navigation to be studied before terrestrial and coastal navigation. What is necessary is that all the material is covered and that teaching is effective to allow trainees to meet the standard of the required performance.

2.1 MONITOR AND LOADING, STOWAGE AND SECURING AND UNLOADING OF CARGOES AND THEIR CARE DURING THE VOYAGE

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of: STCW Code

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2.1.1 THE EFFECT OF CARGO INCLUDING HEAVY LIFTS ON THE SEA-WORTHINESS AND STABILITY OF THE SHIP

2.1.2 THE SAFE HANDLING, STOWAGE AND SECURING OF CARGOES INCLUDING DANGEROUS, HAZARDOUS AND HARMFUL CARGOES AND THEIR EFFECT ON THE SAFETY OF LIFE AND OF THE SHIP

2.1.1 EFFECT OF CARGO ON SEA-WORTHINESS AND STABILITY OF THE SHIP

Textbooks: T11, T36, T59, T63
Teaching aids: A1, A2, V1, V9
Required performance:

2.1.1.1 Draught, Trim and Stability (10 4-hours)  
- defines 'deadweight' and 'displacement tonnages'
- sketches a ship's load line indicating marks for various seasonal zones, areas and periods
- uses a ship's hydrostatic particulars and given mean draughts to determine the approximate weight loaded or discharged
- uses a deadweight scale to determine the change in mean draught resulting from loading or discharging a given tonnage
- given the present draughts and the density of dock water, calculates the draughts in seawater
- given the draught amidships and dock-water density, calculates the amount to load to bring the ship to the appropriate load line in seawater
- uses hydrostatic data to find the position of the centre of flotation, MCT and TPC for a given draught
- calculates the change of trim resulting from loading or discharging a given weight at a specified position
- given the initial draughts, forward and aft, calculates the new draughts after loading or discharging a given quantity of cargo
- uses a trimming table or curves to determine changes in draughts resulting from loading, discharging or moving weights
- calculates final draughts and trim for a planned loading by considering changes to a similar previous loading
- calculates, by using moments about the keel, the position of G for a given disposition of cargo, fuel and water

- uses hydrostatic data to find the KM and thence the GM

- states that, for a cargo ship, the recommended initial GM should not normally be less than 0.15m

- uses KN curves to construct a curve of statical stability and from it reads the maximum righting lever and angle at which it occurs

- calculates the arrival of GM from the departure conditions and the consumption of fuel and water, including the loss of GM due to FSE

- plans the use of fuel and water to keep free surface effects to a minimum

- estimates the loss of GM resulting from absorption of water by deck cargo

2.1.1.2 Securing Cargoes (62 hours) R10

- explains the need for solid stow and securing of all cargoes

- states that cargo liable to slide during rolling, such as steel rails, should be stowed fore and aft

- describes methods of blocking, lashing, shoring, chocking and tombing cargo

- describes methods of securing cargo faces resulting from part discharge before making a sea passage

- describes methods of securing heavy loads and heavy lifts

- describes methods of stowing and securing vehicles and trailers

- states that unitized, containers, trailers, portable tanks and other cargo units should be secured in accordance with the ship's cargo securing arrangements manual
describes passenger operations including passenger cargo, passenger comfort and safety

2.1.1.3 Deck Cargo (64-hours)  
- states that cargoes, other than in containers, commonly carried on deck are:
  - dangerous goods not permitted below decks
  - large units, difficult or impossible to stow below deck, which can safely be exposed to the elements
  - cargoes which can be exposed to the weather and which would occupy a very large space below decks
  - livestock in limited numbers
- explains why efficient securing of cargoes is essential for the safety of the ship as well as the cargo
- states that stowage and securing of deck cargo should be adequate for the worst conditions which could be experienced
- states that hatches should be securely closed and cleated before loading over them
- states that stowage should leave safe access to essential equipment and spaces needed to navigate and operate the ship such as:
  - sounding pipes to tanks and bilges
  - devices for the remote operation of valves
  - mooring arrangements
  - fire-fighting and life-saving equipment
  - crew accommodation and working spaces
  - protection for the crew
- states that deck cargo should not obstruct the view from the navigating bridge or overside at the bow
- explains that the weight of deck cargo should not exceed the maximum permissible load on the deck or hatches
- describes how the effects of a concentrated load can be spread over a wider area by the use of dunnage and deck shoring taking into consideration the positioning of girders, transverses and longitudinals under the tank top
- explains the effect of deck cargo on stability with reference to:
  - its vertical moment about the keel
  - the absorption of water or accretion of ice
  - the clearing of water from the deck in heavy weather
  - increased reserve buoyancy of a timber deck cargo
- describes in outline the recommendations on the stowage and lashing of timer deck cargoes as set out in the IMO Code of Safe Practice for Ships Carrying Timer Deck Cargoes
- describes the guard lines or rails to be provided at the sides of a deck stow and at openings in the stow
- describes the provision of means of safe access between the deck and the top of the stow
- describes the method of safe stowage and securing of containers on deck on vessels not specially designed for the carriage of containers
- describes the safe loading/discharging of Ro-Ro cargoes

1.2.1.4 Container Cargo (4 2-hours)
- describes the arrangement of a container ship and explains how the position of a particular container is designated
- explains briefly the sequence of operations during discharging and loading at a terminal
- explains the factors involved in planning a container stow with reference to:
  - stability, trim and list
  - stresses
  - stack height and weight
  - dangerous goods
  - special stowage restrictions
  - out of gauge
- describes methods of securing containers on deck
- describes the types and sizes of container in use

2.1.1.5 Bulk Cargo (Other Than Grain) (3 hours) R7, R11
- describes in outline the contents of the IMO Code of Safe Practice for Solid Bulk Cargoes (BC Code) International Maritime Solid Bulk Cargo (IMBSC) Code
- defines:
  - angle of repose
  - cargoes which may liquefy - flow moisture point
  - flow state
  - transportable moisture limit
- describes in detail the preparation of cargo holds prior to loading bulk cargoes
- explains that separation between certain bulk cargoes and other than bulk cargoes or package of dangerous goods is required
- explains that some bulk cargoes may deplete the oxygen content of holds or produce toxic gases and describes the precautions to take before entry of holds
- describes the hazards associated with coal cargoes
- describes the importance of monitoring the temperature of the holds associated with carriage of coal cargoes
- describes the precautions to take during loading and discharging coal
- explains how coal should be ventilated

2.1.1.6 Bulk Grain Cargo (2 hours) R2, R16
- defines the following terms as used in the International Grain Code:
  - grain
  - filled compartment
  - partly filled compartment
- describes the cleaning and preparation of holds and decks for the carriage of grain
- states that a thorough check for insect or rodent infestation should be made
- describes the dangers associated with using insecticide in cargo holds
- explains the importance of trimming and states how it should be made
- distinguishes between the trimming of filled and partly filled compartments
- describes the use of fitting of shifting boards
- describes how saucers or bundles of bulk grain are arranged in the square of a hatch to reduce heeling moments resulting from a shift of grain
- describes how the surface of a partly filled compartment is secured against movement
- describes how to separate two different bulk grain cargoes loaded into the same compartment
2.1.2 SAFE HANDLING STOWAGE

Textbooks: T31, T36, T41, T59, T63
Teaching aids: A1, A2, V3, V4, V5, V6, V7, VB8, V10

Required performance:

2.1.2.1 Cargo Care (9 hours)

Inspection and Preparation of Holds
- outlines the reasons for a general inspection of holds
- lists items to be inspected
- explains the importance of cleaning holds before loading
- describes how to clean holds after discharge of a general cargo
- states describes the reasons for using dunnage
- describes the types and sizes of material used for dunnage
- states describes the methods of dunnaging a hold for various cargoes and how to dispose of old dunnage
- explains states that dirty dunnage may taint or contaminate the next cargo
- describes the fitting or spar ceiling and explains its purpose
- states that bilges or drain wells should be clean, dry and sweet-smelling disinfectants used
- explains how bilge suctions should be checked for efficient working scuppers and sounding pipes
- describes how limbers and drain well covers should be treated to prevent suctions being blocked by small debris, but ensuring free drainage to the suctions
- states that the ballast lines to deep tanks should be blanked when preparing to load dry cargo
- states that the use of a deodorizing wash for ozonator may be necessary to remove strong odours from a previous cargo

Segregation and Separation of Cargoes
- explains the need for the segregation of different cargoes with reference to:
  - dangerous goods
  - dry cargo
- wet cargo
- clean cargo
- dirty cargo
- delicate cargo
- valuable cargo, e.g. bank notes, personal effects

- describes how the cargoes in the above objectives can be segregated
- explains that separation between parcels of cargo for different consignees or different ports of discharge is required
- describes methods of separating adjacent parcels of cargo
- describes the use of port marking to separate parcels for discharge at different ports

Ventilation and Control
- lists the factors involved in the control of sweat by ventilation
- distinguishes between ship’s sweat and cargo sweat and explains the conditions in which each is experienced
- describes the system of natural ventilation and how it should be controlled to minimise the formation of sweat
- describes forced ventilation and humidity control for cargo holds and states the properties measured and recorded at the control panel
- explains how to operate the ventilation system described in the above objective
- states that ventilation is also required for the removal of heat, gases and odours
- gives examples of cargoes requiring special ventilation

Refrigerated Cargo
- explains how holds and lockers are prepared for loading
- explains the need for the pre-cooling of spaces and dunnage to be used
- describes the dunnaging requirements for refrigerated cargo
- gives examples of commodities carried chilled
- gives examples of frozen cargoes
- lists the inspections of the cargo which should be made before and during the loading
- describes the use of brine traps in compartment drains - before this stage
- explains the purpose of compartment temperature recordings

2.1.2.2 Dangerous, Hazardous and Harmful Cargoes (8 4 hours)
- explains the different types of containment covered by the term "packaged form"
- describes the classification of dangerous goods in the International Maritime Dangerous Goods (IMDG) Code
- explains the properties, characteristics and physical state of the different substances, materials and articles covered by the 9 classes of the IMDG Code
- identifies the marking, labelling and placarding of dangerous goods as required by the IMDG Code and DGs in limited quantities, e.g. schedule 18
- states that the duty officer should have information on the quantities, types of package, proper shipping names (correct technical names), classification, stowage and segregation of the dangerous goods to be handled
- states that the duty officer should have information on the special measures to be taken when a certain dangerous cargo is handled
- states that the measures to be taken in the event of an incident or accident should be made known and that any necessary equipment and sufficient crew to operate it should be available
- explain where to look for damage and defects most commonly encountered due to:
  - loading and unloading operation
  - corrosion
  - severe weather conditions
- explains that the actions to be taken are laid down in the IMO Emergency Procedures for Ships Carrying Dangerous Goods (EmS), the IMO Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG) and the International Medical Guide for Ships (IMGS)
- states that any incident or accident during the handling of dangerous goods should be reported immediately to the person in charge of the operation and all cargo operations to be ceased
- explains that the IMDG Code lays down the packing requirements
- states that any doubts about the suitability and integrity of packages should be reported to the master or chief mate
- states the fire precautions which should be taken when carrying dangerous goods
- states describes the precautions which should be taken while loading or discharging explosives
- explains with the aid of diagrams, the meaning of the following stowage and segregation requirements for the different types of ships:
  - on deck only
  - on deck or under deck
  - away from
  - separated from
  - separated by a complete compartment or hold from
  - separated longitudinally by an intervening complete compartment or hold

2.1.2.3 Cargo Handling Equipment and Safety (7 hours)

**Cargo Handling Equipment**
- describes the care and maintenance of:
  - standing rigging
  - topping lifts, cargo runners, guys and preventers - cargo blocks and topping lift blocks
  - derrick heel fittings

- describes the rigging of derricks for loading and discharging cargo:
  - using married falls (union purchase)
  - by single swinging derrick

- explains how to set up guys and preventers for working with married falls

- states that gear should be set up in accordance with the ship's rigging plan and explains limitations and effect of angles between runners

- describes how to change the rig from single runners to gun tackles

- describes how to top and lower derricks safely

- describes means of securing derricks for sea

- describes the use of slings, snotters, canvas slings, trays, pallets, nets, chain slings, cant hooks, bale hooks and vehicle slings
states describes the precautions to take when lifting bales with hooks in the bale bands and damage caused by hooks generally

describes the handling of common unitized and pre-slung loads

comparises the advantages and disadvantages of ship's cranes and derricks for handling cargo - types of derricks - Hallen, Stullen, Thompson, Velle etc.

states describes the precautions to be taken when fork-lift trucks or similar devices are used in the 'tween-decks or holds

Cargo Handling Safety
- states that all cargo gear should be visually inspected before the start of cargo operations each day and awareness of test certifications and registration

- describes the importance of having a Safe Working Load (SWL) for the cargo gear

- states explains why the load on cargo gear should never exceed its safe working load

- states that all ropes and wires should come with the certificate of their properties

- states that ropes, wires, blocks and loose gear should be subject to frequent inspections while in use for cargo operations

- explains how to determine when a cargo runner needs replacing

- states that mechanically or hydraulically operated hatches should be opened or closed by the ship's crew under the supervision of a responsible person

- explains states that hatch covers should be secured by locking devices to prevent them moving accidentally

- states that beams and covers of partially opened hatches should be secured to prevent their accidental displacement

- states that hatch openings should be securely fenced to a minimum height of 1 metre

- states that it is the ship's responsibility to cover hatches when notice of completion of work for the day is given by the stevedore in charge

- states that no person should use a ladder in the square of a hatch while cargo is being hoisted or lowered in that square

- states that no person should stand or pass under a suspended load
describes the provision of adequate lighting for working spaces, portable lights and precaution with dangerous cargoes, e.g. jute

states that portable lights should be removed from cargo spaces as soon as they are no longer required

explains that unattended portable lights are potential fire hazards

states that unattended portable lights are potential fire hazards

describes the importance of maintaining close communication with the shore during the loading and unloading stage

describes the information that should be agreed between ship and shore before any loading or unloading operation

2.1.2.4 Oil Tanker Piping and Pumping Arrangements (4 hours)

Tanker Arrangement

describes, for crude carriers and product tankers, the general arrangement of:
  - cargo tanks
  - pump-rooms
  - segregated ballast tanks
  - slop tanks
  - cofferdams - peak tanks - deep tanks
  - accommodation
  - ventilators leading to accommodation and machinery spaces

Cargo Piping System

describes the direct pipeline arrangement in crude carriers

describes the ring-main system in a product tanker

describes the piping arrangements in a pump-room

describes the system of individual deep-well pumps for a product tanker

explains the arrangement and use of:
  - deck lines
  - drop lines
  - stripping lines
  - crossovers
  - bypasses
  - master valves
  - tank suction valves
  - sea suction valves

Cargo Pumps

describes the main operating features of centrifugal pumps
- explains why most cargo pumps are of centrifugal type
- describes the main operating features of the following positive-displacement pumps:
  - reciprocating
  - screw
- states the applications for which positive-displacement pumps are most suitable
- describes how eductors work and gives examples of their use
- describes the conditions for which the pumps are being used such as stripping
- describes the safe handling of chemical cargoes
- describes the safe handling of liquefied gas cargoes
- describes the used of ship/shore checklist
- describe the importance of setting the right pumping rate during the loading and unloading operation

2.1.2.5 Precautions Before Entering Enclosed or Contaminated Spaces (2 hours)

- lists potentially dangerous spaces, including:
  - cargo spaces
  - cargo, fuel and ballast tanks
  - pump-rooms
  - cofferdams
  - duct keels, peak tanks, double bottom tanks
- states that enclosed spaces should be entered only with authorization and after appropriate safety checks have been carried out
- states that an enclosed space may be lacking in oxygen or contain flammable or toxic gases
- states that the master or responsible officer must ensure that a space is safe for entry by:
  - ensuring that the space has been thoroughly ventilated
  - testing at several levels for oxygen content and the presence of harmful vapours
  - requiring breathing apparatus to be worn when there is any doubt about the adequacy of ventilation or testing
- states that the oxygen content should be 21 % by volume before entry is permitted
- defines TLV, TWA, and STEL, and gives examples of their value
states that the concentration of harmful vapour should be below its threshold limit value (TLV)
- explains that a space where the atmosphere is known to be unsafe should be entered only in an emergency, after safety checks have been carried out, and wearing breathing apparatus
- describes a permit-to-enter system using safety checklists to be followed by the responsible officer and the person(s) entering the space
- states that risk assessment must be carried out before the entry into enclosed spaces, with reference to T70
- lists the items appearing on the checklists
- describes the protective clothing and equipment which should be used by or be available to those entering the space
- states that mechanical ventilation should be maintained throughout the time persons are in an enclosed space
- explains why periodical tests of the atmosphere should be made by persons working in an enclosed space
- states that all safety checks should be repeated before re-entering a space after a break
- states that a permit-to-work system should only be for the specific duration of the work for that particular day and not valid for the following day
- states that after work is completed, the area must be closed and secured

Cargo Calculations and Cargo Plans (5 hours)
- distinguishes between bale capacity and grain capacity
- defines 'stowage factor'
- explains defines 'broken stowage' and states how an allowance for it is made
- given the capacity to hold and the stowage factor of the cargo, calculates the weight that the holds will contain
- given the weights and stowage factors of one or more cargoes, calculates the space required
- calculates the number of packages of given dimensions which can be loaded in a stated space, making allowance for broken stowage
- given the maximum permissible loading of a 'tween-deck, calculates the maximum height to which cargo of stated stowage factor can be loaded
- given the maximum permissible loading and height of a 'tween-deck, and the stowage factors of two commodities, calculates the depth of each required to fill the space at the maximum permitted deck loading.
- defines 'ullage'
- describes the uses of tank calibration tables and given cargo density to calculate the weight in a tank
- corrects densities for temperature
- describes the uses of tank calibration tables and given weights and densities of cargo to determine the ullages required
- determines the ullage to leave to produce a given minimum ullage after allowing for expansion of cargo
- extracts information from cargo plans of general cargo ships or container ships
- draws up a cargo plan from given information
- demonstrates the uses of a hold capacity plan to estimate the depth of cargo in a hold or the area of 'tween-deck required for a given cargo
- demonstrates the uses of a capacity plan to estimate the quantity of cargo which can be loaded in part of a 'tween-deck

2.2 INSPECT AND REPORT DEFECTS AND DAMAGE TO CARGO SPACES, HATCH COVERS AND BALLAST TANKS

Textbooks: T31, T36, T70, T74
Teaching aids: A1, A2, V9, V11, V12, V15, V16, V17, V20, V21, V22, V24

Required performance:

2.2.1 Cargo Space Inspections

- Describes the possible causes of damage to the cargo space during cargo operation
- Describes the general layout of a cargo space for a bulk carrier
- Describes the general layout of the cargo space for an oil tanker
- Describes the general layout of the cargo space for a container vessel
- Describes the general layout of a general cargo ship
- Describes the defects that could arise due to the nature of cargo carried
- Describes the corrosion effect that could arise due to structural stress, uneven distribution of cargo, chemical reactions on the ship structure
- Lists the methods in use to prevent the occurrence of corrosion in cargo spaces
- Describes the damage to cargo space due to severe weather condition
- Identifies structural or parts to be inspected each time in order to cover all parts within a given period of time
- Describes the safety procedures before entry into the cargo tank for inspection

2.2.2 Hatch covers inspection

- Describes the working principles of a hatch cover
- Explains the construction of a hatch cover
- Identifies the difference between watertight and weathertight
- Identifies the critical components of the hatch cover that contribute to weathertightness
- Identifies the critical components of the hatch cover that contribute to watertightness
- Identifies the structural components of a hatch cover which are most likely to experience corrosion
- Describes the testing methods for a hatch cover

2.2.3 Ballast tanks inspection

- Describes the purpose of ballast tanks
- Reproduces the construction sketch of a ballast tank
- Identifies the parts in the ballast tanks which are most likely to experience corrosion
- Lists the period of interval for the inspection of ballast tanks
- Describes the corrosion prevention methods for ballast tanks

2.2.4 Damage report

- Lists the items that need to be taken into account where preparing a damage report
- Lists the evidence that needs to be collected in assisting the preparation of a damage report
2.2.5 Enhanced Survey Programme

- Describes the guidelines on the Enhanced Programme of Inspections during surveys of Bulk Carriers
- Describes the guidelines on the Enhanced Programme of Inspections during surveys of Oil Tankers
Function 3:

Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level
Function 3: Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level

Part B3: Course Outline and Guidance Notes

Timetable
No formal example of a timetable is included in this model course.

Development of a detailed timetable depends on the level of skills of the trainees entering the course and the amount of revision work of basic principles that may be required.

Lecturers must develop their own timetable depending on:
- the level of skills of trainees
- the numbers to be trained
- the number of instructors, and
- normal practices at the training establishment.

Preparation and planning constitute an important factor which makes a major contribution to the effective presentation of any course of instruction.

Lectures
As far as possible, lectures should be presented within a familiar context and should make use of practical examples. They should be well illustrated with diagrams, photographs and charts where appropriate, and be related to matter learned during seagoing time.

An effective manner of presentation is to develop a technique of giving information and then reinforcing it. For example, first tell the trainees briefly what you are going to present to them; then cover the topic in detail; and, finally, summarise what you have told them. The use of an overhead projector and the distribution of copies of the transparencies as trainees handouts contribute to the learning process.

Course outline
The tables that follow list the competencies and areas of knowledge, understanding and proficiency, together with the estimated total hours required for lectures and practical exercises. Teaching staff should note that timings are suggestions only and should be adapted to suit individual groups of trainees depending on their experience, ability, equipment and staff available for training.
COURSE OUTLINE

Competence:

3.1 ENSURE COMPLIANCE WITH POLLUTION-PREVENTION REQUIREMENTS

3.1.1 THE PRECAUTIONS TO BE TAKEN TO PREVENT POLLUTION OF THE MARINE ENVIRONMENT

.1 MARPOL 73/78  7

3.1.2 ANTI-POLLUTION PROCEDURES AND ASSOCIATED EQUIPMENT

.1 Regulation 26 - Annex.1 MAR POL 73/78  2
.2 Anti-Pollution Equipment  1  3

3.2 MAINTAIN THE SEAWORTHINESS OF THE SHIP

3.2.1 SHIP STABILITY

.1 Displacement  4
.2 Buoyancy  2
.3 Fresh water allowance  3
.4 Statical stability  3
.5 Initial stability  4
.6 Angle of loll  1
.7 Curves of statical stability  4
.8 Movement of centre of gravity  4
.9 List and Its Correction  6
.10 Effect of slack tanks  3
.11 Trim  6
.12 Loss of intact buoyancy  1  41

3.2.2 SHIP CONSTRUCTION

.1 Ship dimensions and form  12
.2 Ship Stresses  8
.3 Hull structure  11
.4 Bow and stern  6
.5 Fittings  10
.6 Rudders and propellers  11
.7 Load lines and draught marks  5  63
3.3 PREVENT, CONTROL AND FIGHT FIRES ON BOARD
See IMO Model Course No 2.03 and STCW 1995 Regulation VI/3

Teaching staff should note that the hours for lectures and exercises are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adapted by lecturers to suit individual groups of trainees depending on their experience, ability, equipment and staff available for teaching.

3.4 OPERATE LIFE-SAVING APPLIANCES
See IMO Model Course No 1.23, and STCW 1995 Regulation VI/2 paragraph 1-4

3.5 APPLY MEDICAL FIRST AID ON BOARD SHIP
See IMO Model Course No 1.14 and STCW 1995 Regulation VI/4 paragraph 1-3

3.6 MONITOR COMPLIANCE WITH LEGISLATIVE REQUIREMENTS

3.6.1 BASIC WORKING KNOWLEDGE OF THE RELEVANT IMO CONVENTIONS CONCERNING SAFETY OF LIFE AT SEA AND PROTECTION OF THE MARINE ENVIRONMENT

International Convention on load Lines, 1966 3
SOLAS, 1974 as amended 2
SOLAS - Subdivision and stability 2
SOLAS - Fire protection, detection and extinction 2
SOLAS - LSA and arrangements (LSA Code) 2
SOLAS - radiotelegraphy and R/T 2
SOLAS - Radio communications (amended Chap. 1V) 2
SOLAS - Carriage of grain 1
SOLAS - Carriage of dangerous goods 1
STCW, 1995 2
ITU Radio regulations 2
STP ships Agreement, 1971 1
SPACE STP, 1973 1
PAL, 1974 and Tonnage 1969 1
BWM 2004 1

24 25
3.7 APPLICATION OF LEADERSHIP AND TEAMWORKING SKILLS
See draft IMO Model Course and STCW 2010 Regulation I/ and Section A-VI/1 paragraph

3.8 CONTRIBUTE TO SAFETY OF PERSONNEL AND SHIP
See IMO Model Course No 1.13, 1.19, 1.20, 1.21, and STCW 1995 Regulation VI/1 and Section A-VI/1 paragraph 2

Total for Function 3:
Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level

138 161

Teaching staff should note that the hours for lectures and exercises are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adapted by lecturers to suit individual groups of trainees depending on their experience, ability, equipment and staff available for teaching.
Guidance Notes

The following notes are intended to high light the main objectives or training outcomes of each part of the function. The notes also contain some material on topics which are not adequately covered in the quoted references.

Trainees will be aware of the need and the practical measures required by law to prevent pollution of the environment. They will understand the requirements of MARPOL, (R4) the technical annexes, control of oil from machinery spaces and the Oil Record Book (Part 1), (RS, V7).

Function 3: Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level

On completion of training for this function trainees will be able to use plans and tables or diagrams of stability and trim data to calculate the ship's initial stability, draughts and trim for any given disposition of cargo and other weights. They will also be able to determine whether stresses on the ship are within permitted limits by the use of stress data, calculating equipment or software. The fundamental actions to take in the event of partial loss of intact buoyancy will be understood.

They will have a knowledge of the principal structural members of a ship and the proper names of the various parts.

Training concerned with Advanced Training in Fire-fighting is covered in IMO model course 2.03.

Training concerned with proficiency in survival craft and rescue boats other than fast rescue boats is covered in IMO model course 1.23.

Training concerned with proficiency in medical first aid on board ship is covered in IMO model courses 1.14.

3.1 Ensure Compliance with Pollution-Prevention Requirements

3.1.1 THE PRECAUTIONS TO BE TAKEN TO PREVENT POLLUTION OF THE MARINE ENVIRONMENT

Prevention of Pollution
In implementing this section of the course, the instructor should bear in mind that any officer of the watch aboard tankers will have completed a tanker familiarization course which should include the relevant requirements on pollution prevention related to tanker operations. This section is intended to provide an outline knowledge of the MARPOL Convention. In the following sections, detailed treatment should be confined to those requirements of the Convention which apply to all ships (V1, V2)
MARPOL technical annexes
The annexes set out the rules for the construction and equipment of ships and for ships’ operations which may result in marine pollution.

Annex I
Oil is defined in Annex I as any mineral oil and includes petrochemical products other than those listed in Annex II.

Compliance with construction and equipment requirements is enforced through the International Oil Pollution Prevention (IOPP) Certificate and regular surveys to ensure that the ship continues to comply with the requirements of the certificate. Port States verify that a ship has a certificate and may, if necessary, carry out a survey and demand rectification of deficiencies. The Port State also inspects the Oil Record Book to check that the ship is adhering to the required operating procedures. Coastal States may enforce Annex I by regular air patrols which keep a watch for oil slicks.

Control of oil from machinery spaces
Waste oil is generated in lubricating oil and fuel oil purifiers. Under Annex I, discharge of this sludge into the sea is not permitted.

Oil and water leakages in machinery spaces give rise to oil and water mixtures in bilges which have to be disposed of from time to time to prevent them becoming a fire or stability hazard. Many ships have bilge-water holding tanks to enable bilges to be kept clean and dry in port. The contents of the tank can then be discharged at sea, using a separator. The separated oil is dealt with in the same way as other waste oil. The need to retain this on board until arrangements can be made for disposal requires the provision of a tank for oil residues. Annex I makes provision for this.

The equipment required for machinery spaces is set out in the regulations. The discharge provisions are similarly governed.

Oil Record Book (Part I, Machinery Space Operations)
The requirements for keeping records and the form of the Oil Record Book are set out in the relevant regulations (V7).

Precautions which should be taken to prevent accidental pollution by oil
Officers who are to serve in oil, chemical or gas tankers will undertake specialised courses which include pollution-prevention precautions applicable to those specialised ships. The precautions in this section apply to bunkering and the discharge of oily wastes, which are operations common to all ships, and are similar to those to be taken when loading or discharging an oil cargo (V6).

Sewage
Under Annex IV ships are not permitted to discharge sewage within four miles of the nearest land, unless they have in operation an approved treatment plant. Between 4 and 12 miles from land, sewage must be comminuted and disinfected before discharge.
3.2 Maintain the Seaworthiness of the Ship

3.2.1 STABILITY, TRIM AND STRESS TABLES

A ship's hydrostatic information is given for the even keel condition, so the true mean draught should be used to enter the tables or graphs. Since a ship is rarely on an even keel when draughts are read, either a calculation to correct the arithmetical mean draught must be made or the arithmetical mean draught may be used as an approximation.

Unless trim angles are excessive, the errors resulting from using arithmetical mean draught are small. In cases where complex accuracy is essential, draught surveys for example, the calculations would not be left to the officer of the watch. For the purposes of this course the arithmetical mean draught may be used when working with hydrostatic curves or tables. Data suitable for the preparation of exercises are contained in the Annex to these guidance notes. See also ref V3.

Displacement
Archimedes' law and the principles of flotation should have been covered in physical science before starting this subject.

Buoyancy
Buoyancy in general should have been covered in physical science. The concept of reserve buoyancy and its importance to the safety of the ship should be emphasized.

Fresh water allowance
This should be developed by considering the relationship between buoyancy and water density. Calculations on box-shaped vessels can be used to show how the TPC for fresh water or dock water is related to the tabulated value for seawater.

Statistical stability
This section introduces the lever GZ as the horizontal separation between the equal and opposite forces through G and B. The tendency for a stable ship to return to the upright is shown to depend upon the resulting couple.

Initial stability
The transverse metacentre is introduced and the way in which GZ is related to the metacentric height for small angles of heel is derived. A comparison of the behaviour of stiff and tender ships in a seaway is included. A floating model can be used to demonstrate the effect on rolling period.

Angle of loll
The fact that an initial capsizing moment results if G is above M is to be shown. It may be possible to show an angle of loll by using a floating model although it is difficult to avoid large angles of list, due to slight displacement of the model's centre of gravity, confusing the experiment. Even so, the experiment demonstrates the unsatisfactory condition of a ship with a GM of nearly zero.
Curves of statical stability
Trainees should construct and appraise some curves of statical stability, using KN curves and given values of KG, including a curve for a ship with a negative GM.

Movement of the centre of gravity
Trainees should be able to deduce that adding masses above, or removing masses below, the original centre of gravity causes an increase in KG. Both processes can occur during a passage as water is absorbed by deck cargo and fuel is consumed from double-bottom tanks.

When dealing with the point of suspension, point out that lowering or raising the weight has no effect on the ship's centre of gravity. Only movement of the point of suspension, where the weight is acting, has any effect on KG.

List and its correction
Trainees should be reminded that the equation for angle of list applies only for small angles of list, up to about 10°, for which the position of M can be taken as fixed.

Effect of slack tanks
It should be pointed out that any free liquid surface, such as water trapped on the weather deck or water used for fire fighting, will cause a similar increase in the value of KG.

Trim
The calculation of trim and final draughts after large changes in deadweight is not included. The lecturer should explain why trim tables should not be used for large changes in deadweight. The theory behind a vessel's change in trim due to a change in water density may also be covered.

In tankers and bulk carriers, the quantity and disposition of cargo is often similar to that of a previous loading. When planning the loading of such a cargo, the final draughts and trim can be obtained by making the necessary small adjustments to the actual draughts recorded for the previous cargo.

Actions to be taken in the event of a partial loss of intact buoyancy
The immediate actions which should be taken by the officer in charge of the watch are aimed at limiting the volume of lost buoyancy to the minimum. At the same time, if cross-flooding arrangements are required, they should be put into operation immediately to restrict the angle of list. Whether anything can be done to stop or reduce the inflow of water will depend upon the circumstances. In the event of loss of buoyancy due to damage to a hatch cover, a prompt reduction in speed or alteration of course, or both, may be effective.
3.2.2 SHIP CONSTRUCTION

The trainees should have a knowledge of the principal structural members of a ship and the proper names of the various parts. Their knowledge should be such that they are capable of intelligent observation during the ordinary course of their work and could make adequate reports describing the location and nature of faults or minor damage discovered.

Ship dimensions and form
Particulars of constructional details of the various ship types are not intended. A knowledge of the general arrangement of various ship types is also applicable to other areas, such as cargo work and pollution prevention.

Ship stresses
A mathematical treatment of shear force and bending moments is not required at this stage. A qualitative description to explain the forces which the ship must be designed to withstand and the parts mainly involved in resisting them is needed.

When dealing with liquid pressure in tanks, attention should be drawn to the high forces on tank tops resulting from filling tanks until there is a head of liquid in air pipes and sounding pipes.

Hull structure
This section deals with the main structure of the hull, the names of the principal parts and how they are connected. Models and three-dimensional drawings are valuable aids to understanding the various connections and stiffening arrangements shown on the usual plan and elevation drawings.

Bow and stern
Details of construction have been limited to the transom stern since that is the commonest construction at present.

Fittings
The closing of hatches with wooden covers and tarpaulins has been included because there are still a number of older ships with that arrangement or a similar one using pontoon covers.

When dealing with bilge or ballast piping systems, show how the non-return valves are placed to prevent flooding of adjacent spaces through fractured pipelines. When dry cargo is carried in deep tanks, the ballast lines have blanks fitted to prevent accidental filling of the tanks. A similar arrangement is provided in cargo holds which are connected to the ballast system.

Rudders and propellers
Knowledge of the method of operation of controllable-pitch propellers is not required. Trainees should be aware that the amount and direction of thrust are controlled by altering the pitch of the propeller. They should also realize that when going astern a controllable-pitch propeller acts as an opposite-handed propeller to when going ahead. Many controllable-pitch propellers are made left-handed going ahead so that
they behave in the same way as the usual right-handed propellers when acting astern.

**Load lines and draught marks**

It is not intended that trainees should know how the summer freeboard is assigned. They should know that it is the minimum freeboard permitted when loading in seawater in a summer zone and that it is assigned to the ship by, or on behalf of, the Administration in accordance with the Load Line Regulations. They should also know that the load line mark is placed at that distance below the deck line.

It should be impressed upon trainees that, when loading to the minimum permitted freeboard, checks should be made of the actual freeboard amidships on each side. Even a barely perceptible list can produce a difference of several centimetres in the readings from opposite sides.

### 3.3 Prevent, Control and Fight Fires on Board

The requirements of the STCW Convention are covered by IMO model courses, Basic Fire Fighting and Advanced Fire Fighting. These courses is based on the recommendations set out in IMO Assembly resolution and the IMO/ILO Document for Guidance (R28).

Trainees should undertake this course as soon as possible in their career, preferably during the pre-sea stage at a shore-based establishment.

IMO Assembly resolution states "Masters, officers and as far as practicable key personnel who may wish to control fire-fighting operations should have advanced training in techniques for fighting fire with particular emphasis on organization, tactics and command".

IMO model course, Advanced Training in Fire Fighting is suitable for this purpose and Administrations may wish this course to be completed before trainees qualify as officer in charge of a watch. See also IMO Model Course No 2.03.

### 3.4 Operate Life-Saving Appliances

The requirements of the STCW Convention are fully covered by IMO model course 1.23, Proficiency in Survival Craft and Rescue Boats other than Fast Rescue Boats, which is based on the requirements of the STCW Convention. Trainees who have successfully completed that course and have been issued with a certificate of proficiency in survival craft have demonstrated the ability and knowledge necessary to satisfy the requirements of the regulations.
3.5 Apply Medical First Aid on Board Ship

The requirements of the STCW Convention are covered by IMO model course 1.14.

3.6 Monitor Compliance with Legislative Requirements

3.6.1 BASIC WORKING KNOWLEDGE OF THE RELEVANT IMO CONVENTIONS CONCERNING SAFETY OF LIFE AT SEA AND PROTECTION OF THE MARINE ENVIRONMENT

The extent and depth of knowledge required of the IMO Conventions and implementation by flag state law is greater than was required by the 1978 Convention. A working knowledge of IMO Conventions concerning safety of life and protection of the marine environment is required. This includes Load Line, Tonnage, PAL, STP, SOLAS, MARPOL, STCW and ILO Minimum Standards in Merchant Ships Conventions. A knowledge of UNCLOS and international maritime law is also required.

Relatively new additions to maritime law should be noted including The ISM Code (R29) (incorporated as Ch IX of SOLAS, Management for the safe operation of ships); MARPOL 73/78 Annex 1, regulation 26 that requires every oil tanker of 150gt and above and every ship other than a tanker of 400gt and above to have a shipboard oil pollution emergency plan and amendments to MARPOL Annex V that require garbage management plans to be in place.

Introduction to maritime law

Maritime questions are not confined to one country and therefore maritime law has always had an international bias. Historically, customary codes recognized in several countries were applied by the courts. In more recent years their place has been taken by international conventions, which are given force by national legislation enacted by the contracting States. Most maritime law is now statute law, particularly in the areas of safety and prevention of pollution.

Jurisdiction in public international law has been designed to allocate and delimit national sovereign powers. Each State has the right to legislate and enforce legislation on its own territory, subject to respecting other States' sovereignty and international law.

Ships spend much time on the high seas, over which no one has sovereignty, but these are treated as extensions of the flag State, which should exercise its jurisdiction and control in administrative, technical and social matters. The flag State has exclusive jurisdiction over those matters on the high seas. This is referred to as flag State jurisdiction. In general, international conventions specify the rights and duties of the flag State so that a State accepting a convention must enact legislation applicable to its own ships to give it the powers to enforce the provisions of the convention.

A State's power to control the activities of foreign ships in its territorial waters and contiguous zone is called coastal State jurisdiction. For example, a State may
enforce rules regarding traffic separation schemes and anti-pollution measures within its territorial waters. The International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969, gives a coastal State powers to take action in respect of a foreign ship on the high seas in special circumstances.

Port State jurisdiction refers to the power of a State to enforce rules and prosecute violations occurring within the jurisdiction of the port State. Many of the IMO conventions and a few ILO conventions include provisions giving rise to port State jurisdiction. The powers of the port State include inspection of certificates, inspection of the ship and in some cases detention of the ship.

The "no more favourable treatment" clause, mentioned in objective 3.6.1.1 provides that States parties are under the obligation to apply the relevant convention in the same manner to foreign ships flying the flag of a State which is not a party as to ships sailing under the flag of a State Party to the convention. The result is that ships flying the flags of non-party States will have to comply with the standards of those conventions when calling at ports of a State party.

**Law of the sea - on the high seas**

In 1958, four conventions were drawn up at the United Nations Conference on the Law of the Sea at Geneva. They were the Conventions on the Territorial Sea and the Contiguous Zone, on the High Seas, on the Continental Shelf, and on Fishing and Conservation of the Living Resources of the High Seas, all of which are currently in force.

The syllabus is concerned only with those parts of the first three of the conventions mentioned above which are relevant to the master in conducting a voyage.


The Convention establishes a comprehensive framework for the regulation of all ocean space. Its provisions govern, amongst other things, the extent of national sovereignty or jurisdiction, the safety of navigation and the protection of the marine environment from pollution. It provides for the establishment of territorial seas up to 12 miles and an exclusive economic zone of up to 200 miles in breadth over which the coastal State has certain sovereign rights. Many States have given effect to these provisions. It also provides for special regimes that apply to navigation through straits and archipelagic waters.

The Convention entered into force on 16 November 1994. It will of course influence future international maritime conventions and recommendations to the extent that conflict with UNCLOS will be avoided and other measures may be introduced to give substance to certain of its provisions.

**Force majeure** is an exceptional circumstance which is irresistible, beyond anyone's power to resist even with foreknowledge. See the International Convention on Civil Liability for Oil Pollution Damage (1969), Article III, paragraph 2(a), which uses the expression "an act of war, hostilities, civil war, insurrection or a natural phenomenon
of an exceptional, inevitable and irresistible character." They would be examples of
force majeure, but this list is not necessarily exhaustive.

The expression "generally accepted international regulations, procedures and
practices", or one of several similar expressions, is used in a number of the
provisions. The Convention on the Law of the Sea does not give formal definitions for
these expressions, and no clear guidelines are provided as to how the "international
regulations and rules, etc.", referred to in the articles, may be identified. However, it
appears to be generally accepted that the international regulations and standards
adopted by IMO constitute a major component of the "generally accepted"
international regulations and standards in matters relating to safety of navigation and
the prevention and control of marine pollution from ships and by dumping.

Formal and authoritative interpretations of the provisions of UNCLOS can only be
undertaken by the States parties to that Convention or, in appropriate cases, by the
judicial or arbitral tribunals envisaged for that purpose in the convention itself.

Safety
Of all the international conventions dealing with maritime safety the most important is
the International Convention for the Safety of Life at Sea, better known as SOLAS
which covers a wide range of measures designed to improve the safety of shipping.

The convention is also one of the oldest of its kind: the first version was adopted in
1914 following the sinking of the SS Titanic with the loss of more than 1,500 lives.
Since then there have been four more versions of SOLAS. The present version was

Reference should be made to the International Safety Management (ISM) Code,
which sets out the master's responsibility with regard to safety and environmental
protection and in which the watchkeeping officer has a crucial role in discharge of
these responsibilities.

International Convention on Load Lines

SOLAS - LSA Code
Instructors should note that the International Life-Saving Appliance (LSA) Code was
adopted in 1996 and is now in force and mandatory. The Code gives technical and
other details of personal life-saving appliances, visual signals, survival craft, rescue
boats and other life-saving appliances (R30).

IMO has introduced amendments to harmonize the periods between surveys which
will result in equal periods of validity of the different certificates in the near future. The
Annex to these Guidance Notes shows bar diagrams of the harmonized system.

The first survey that a cargo ship undergoes by the flag State Administration is the
initial survey. When the period of validity of a certificate expires, a renewal survey is
required for the new certificate. The annual surveys have different names depending
on the certificate involved.
In the future, the Cargo Ship Safety Construction, Safety Equipment and Safety Radio Certificates may be combined into the Cargo Ship Safety Certificate. This is an option under the SOLAS 1988 protocol which comes into force in February 2000.

Under 3.6.1.3, SOLAS sub-division and stability, trainees should only be expected to know the meaning and application of 'floodable length' and 'factor of subdivision', not the technical details of calculations.

In the section concerned with the SOLAS requirements for life-saving equipment, details of lifesaving appliances, their equipment and their use are covered in IMO Model Courses 1.19, Proficiency in Personal Survival Techniques, and 1.23, Proficiency in Survival Craft and Rescue Boats other than Fast Rescue Boats.

Amendments to the 1974 SOLAS Convention and its Protocol of 1978 were adopted in 1988 to introduce the global maritime distress and safety system. The amendments entered into force, under the ‘tacit acceptance’ provisions of the SOLAS Convention and its 1978 Protocol, on 1 February 1992. Training requirements for the GMDSS general operator’s certificate, see STCW Reg IV/2, are covered in IMO model course 1.25.

**SOLAS - Carriage of grain**
In many countries, the ship must also obtain a grain loading certificate, attesting that the ship has been loaded in accordance with the regulations, before sailing. Such certificates would be issued by an organization authorized by the Administration.

**SOLAS - Carriage of dangerous goods**
Details of the IBC and IGC codes are not required, but trainees should be aware of the survey and certification requirements. Officers who are to serve in chemical tankers or gas carriers will undertake appropriate specialized training.

**STCW Code**
The regulations and recommendations regarding the keeping of safe watches are fully covered in the STCW Convention, Chapter VIII. Trainees should be aware of the requirements concerning the certificates needed by ship's officers and other personnel and the port State control which may be applied.

**ITU Radio Regulations**
The International Telecommunication Union (ITU) is the United Nations Specialized Agency charged with the responsibility for all telecommunication matters, including management of the radiospectrum. The use of the radiospectrum is governed by the provisions of the Radio Regulations.

IMO, in co-operation with ITU, the International Maritime Satellite Organization (INMARSAT), the COSPAS-SARSAT Partners, the World Meteorological Organization (WMO) and the International Hydrographic Organization (IHO), has developed a new system of maritime mobile radiocommunication services to replace
the terrestrial Morse radiotelegraphy and radiotelephone-based system which in various forms has served the shipping industry since the early part of the twentieth century.

The new system, known as the Global Maritime Distress and Safety System (GMDSS), was phased in between 1 February 1992 and 1 February 1999. The system uses both terrestrial and satellite communications and is highly automated. As a result, extensive changes were introduced with respect to the training of personnel who are to operate the system and also with respect to those who may be required to maintain the system.

**Passengers**
Both the Special Trade Passenger Ships Agreement and the Protocol on Space Requirements refer to the International Health Regulations. The relevant sections are Article 84 and Annex V.


**1.9 Leadership and Teamworking Skills**

**1.9.1 APPLICATION OF LEADERSHIP AND TEAMWORKING SKILLS**

In today’s highly demanding shipboard environment, the ship’s officers are expected to act as managers and leaders to their crew and colleagues as well as interact with external parties. It is vital that they possess the knowledge and ability of managing people, plan and coordinate activities on board, as well as making the right decisions through proper judgment and analysis of the situation at the time. At the same time, the officers are required to ensure the company’s objectives are achieved in a timely manner, thus he or she will require the knowledge and understanding of organizing and getting things done through others and in such instances the teamworking skills are important to ensure success.
Part C3: Detailed Teaching Syllabus

Introduction

The detailed teaching syllabus is presented as a series of learning objectives. The objective, therefore, describes what the trainee must do to demonstrate that the specified knowledge or skill has been transferred.

Thus each training outcome is supported by a number of related performance elements in which the trainee is required to be proficient. The teaching syllabus shows the Required performance expected of the trainee in the tables that follow.

In order to assist the instructor, references are shown to indicate IMO references and publications, textbooks and teaching aids that instructors may wish to use in preparing and presenting their lessons.

The material listed in the course framework has been used to structure the detailed teaching syllabus; in particular,

- Teaching aids (indicated by A)
- IMO references (indicated by R) and
- Textbooks (indicated by T)

will provide valuable information to instructors.

Explanation of Information Contained in the Syllabus Tables

The information on each table is systematically organised in the following way. The line at the head of the table describes the FUNCTION with which the training is concerned. A function means a group of tasks, duties and responsibilities as specified in the STCW Code. It describes related activities which make up a professional discipline or traditional departmental responsibility on board.

In this Model course there are three functions:

- Navigation at the Operational Level
- Cargo Handling and Stowage at the Operational Level
- Controlling the Operation of the Ship and Care for Persons on Board at the Operational Level.

The header of the first column denotes the COMPETENCE concerned. Each function comprises a number of competences. For example, the Function 3, Controlling the Operation of the Ship and Care for Persons on board at the operational Level, comprises a number of COMPETENCES. Each competence is uniquely and consistently numbered in this model course.

In this function the competence is Ensure compliance with pollution prevention requirements. It is numbered 3.1, that is the first competence in Function 3. The term competence should be understood as the application of knowledge,
understanding, proficiency, skills, experience for an individual to perform a task, duty or responsibility on board in a safe, efficient and timely manner.

Shown next is the required TRAINING OUTCOME. The training outcomes are the areas of knowledge, understanding and proficiency in which the trainee must be able to demonstrate knowledge and understanding. Each COMPETENCE comprises a number of training outcomes. For example, the above competence comprises two training outcomes. The first is concerned with the PRECAUTIONS TO BE TAKEN TO PREVENT POLLUTION OF THE MARINE ENVIRONMENT. Each training outcome is uniquely and consistently numbered in this model course. That concerned with precautions to be taken to prevent pollution of the marine environment is uniquely numbered 3.1.1. For clarity training outcomes are printed in black on grey, for example TRAINING OUTCOME.

Finally, each training outcome embodies a variable number of required performances - as evidence of competence. The instruction, training and learning should lead to the trainee meeting the specified required performance. For the training outcome concerned with precautions to be taken to prevent pollution of the marine environment, there is just one area of performance. This is:

3.1.1.1 MARPOL 73/78

Following each numbered area of required performance there is a list of activities that the trainee should complete and which collectively specify the standard of competence that the trainee must meet. These are for the guidance of teachers and instructors in designing lessons, lectures, tests and exercises for use in the teaching process. For example, under the topic 3.1.1.1, to meet the required performance, the trainee should be able to:

- define for the purpose of MARPOL 73/78: a harmful substance, a discharge, and ship and an incident
- state that violations of the Convention are prohibited and that sanctions should be established for violations
- describes the inspections which may be made by port state authorities and outlines actions which they may take

and so on.
For the training outcome concerned with anti-pollution procedures and associated equipment, there are 2 areas of performance. These are:

3.1.2 ANTI-POLLUTION PROCEDURES AND ASSOCIATED EQUIPMENT

.1 Regulation 26 - Annex.1 MAR POL 73/78  (2 hours)
.2 Anti-Pollution Equipment  (1 hour)

For the training outcome concerned with maintain the seaworthiness of the ship, there are 18 areas of performance. These are:

3.2.1 SHIP STABILITY

.1 Displacement  (4 hours)
.2 Buoyancy  (2 hours)
.3 Fresh water allowance  (3 hours)
.4 Statical stability  (3 hours)
.5 Initial stability  (4 hours)
.6 Angle of loll  (1 hour)
.7 Curves of statical stability  (4 hours)
.8 Movement of centre of gravity  (4 hours)
.9 List and Its Correction  (6 hours)
.10 Effect of slack tanks  (3 hours)
.11 Trim  (6 hours)
.12 Loss of intact buoyancy  (1 hour)

3.2.2 SHIP CONSTRUCTION

.1 Ship dimensions and form  (12 hours)
.2 Ship stresses  (8 hours)
.3 Hull structure  (11 hours)
.4 Bow and stern  (6 hours)
.5 Fittings  (10 hours)
.6 Rudders and propellers  (11 hours)
.7 Load lines and draught marks  (5 hours)

For the training outcome concerned with monitor compliance with legislative requirement, there are 2 areas of performance. These are:

3.6.1 BASIC WORKING KNOWLEDGE OF THE RELEVANT IMO CONVENTIONS CONCERNING SAFETY OF LIFE AT SEA AND PROTECTION OF THE MARINE ENVIRONMENT

- International Convention on load Lines, 1966  (3 hours)
- SOLAS, 1974 as amended  (2 hours)
- SOLAS - Subdivision and stability  (2 hours)
- SOLAS - Fire protection, detection and extinction  (2 hours)
- SOLAS - LSA and arrangements (LSA Code)  (2 hours)
- SOLAS - radiotelegraphy and R/T  (2 hours)
- SOLAS - Radio communications (amended Chap. 1V)  (2 hours)
IMO references (Rx) are listed in the column to the right hand side. Teaching aids (Ax), videos (Vx) and textbooks (Tx) relevant to the training outcome and required performances are placed immediately following the TRAINING OUTCOME title.

It is not intended that lessons are organised to follow the sequence of required performances listed in the Tables. The Syllabus Tables are organised to match with the competence in the STCW Code Table A-II/1. Lessons and teaching should follow college practices. It is not necessary, for example, for celestial navigation to be studied before terrestrial and coastal navigation. What is necessary is that all the material is covered and that teaching is effective to allow trainees to meet the standard of the required performance.

3.1.2 ANTI-POLLUTION PROCEDURES AND ASSOCIATED EQUIPMENT

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

<table>
<thead>
<tr>
<th>STCW Code</th>
<th>Table A-II/1</th>
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</thead>
</table>

3.1.1 THE PRECAUTIONS TO BE TAKEN TO PREVENT POLLUTION OF THE MARINE ENVIRONMENT

3.1.2 ANTI-POLLUTION PROCEDURES AND ALL ASSOCIATED EQUIPMENT

3.1.1 THE PRECAUTIONS TO BE TAKEN TO PREVENT POLLUTION OF THE MARINE ENVIRONMENT

Textbooks: T31, T70
Teaching aids: A1, A2, V1, V2, V6
Required performance:


(7-8 hours)

- defines, for the purpose of MARPOL 73/78:
  - harmful substance
  - discharge
  - ship
  - incident

- states that violations of the Convention are prohibited and that sanctions should be established for violations, wherever they occur, by the Administration of the ship concerned

- describes the inspections which may be made by port State authorities and outlines actions which they may take

- describes the provisions for the detection of violations and enforcement of the Convention

- states that reports on incidents involving harmful substances must be made without delay

**Annex I – Oil**

- defines, for the purposes of Annex I:
  - oil
  - oily mixture
  - oil fuel
  - oil tanker
  - combination carrier
  - nearest land
  - special area
  - instantaneous rate of discharge of oil content
  - wing tank
  - centre tank
  - slop tank
  - clean ballast
  - segregated ballast

- describes the surveys and inspections required under the provisions of MARPOL 73/78

- describes the steps which may be taken if a surveyor finds that the condition of the ship or its equipment is unsatisfactory

- states that the condition of the ship and its equipment should be maintained to conform with the provisions of the Convention
states that the certificate issued after survey is the International Oil Pollution Prevention (IOPP)

Ensure Compliance with Pollution-Prevention Requirements
- states that the IOPP Certificate should be available on board the ship at all times
- states lists the conditions under which oily mixtures may be discharged into the sea from an oil tanker
- states lists the condition under which oily mixtures from machinery-space bilges may be discharged into the sea
- explains states that the provisions do not apply to the discharge of clean or segregated ballast
- explains describes the conditions under which the provisions do not apply to the discharge of oily mixtures from machinery spaces where the oil content without dilution does not exceed 15 parts per million
- states that residues which cannot be discharged into the sea in compliance with the regulations must be retained on board or discharged to reception facilities
- lists states that the special areas for the purposes of Annex I as the Antarctic area, the Baltic Sea area, Mediterranean sea area, Black Sea area, The Gulf area, Gulf of Aden area, Red Sea area and north-west European waters
- states that any discharge into the sea of oil or oily mixtures from an oil tanker or other ships of 400 tons gross tonnage and above is prohibited while in a special area
- states describes the conditions under which a ship, other than an oil tanker, may discharge oily mixtures in a special area
- states that the regulation does not apply to the discharge of clean or segregated ballast
- describes conditions in which processed bilge water from machinery spaces may be discharged in a special area
- describes the exceptional circumstances in which the regulations on the discharge of oil or oily mixtures do not apply
- explains states that ballast water should not normally be carried in cargo tanks of tankers provided with segregated ballast tanks
- explains the exceptions in which ballast may be carried in cargo tanks
- states that every oil tanker operating with crude oil washing systems should be provided with an Operations and Equipment Manual
- states that, in new ships of 4,000 tons gross tonnage and above and in new oil tankers of Reg.14150 tons gross tonnage and above, no ballast water should normally be carried in any oil fuel tank

- states describes the requirements for the provision of Oil Record Books

- lists the entries required for machinery space operations in part A of the Oil Record Book

- lists the entries required in respect of cargo or ballast operations in oil tankers

- states describes the entries required for accidental or other exceptional discharge of oil

- states that the Oil Record Book should be kept on board readily available for inspection and should be preserved for a period of three years after the last entry has been made

**Annex II - Noxious Liquid Substances in Bulk**

- states that describes the requirements of Annex II apply to all ships carrying noxious liquid substances in bulk

- explains states that noxious liquid chemicals are divided into four categories, A, B, C, D, X, Y, Z and OS, such that substances in category A X pose the greatest threat to the marine environment and those in category D Z the least

- states that the conditions for the discharge of any effluent containing substances falling in those categories are specified

- states that more stringent requirements apply in special areas, which for the purposes of Annex II are the Baltic Sea area and the Black Sea area

- explains states that pumping and piping arrangements are to be such that, after unloading, the tanks designated for the carriage of liquids of categories B or C Z do not retain more than certain stipulated quantities of residue

- states that the discharge operations of certain cargo residues and certain tank cleaning and ventilation, operations may only be carried out in accordance with approved procedures and arrangements based on standards developed by IMO

- states that each ship which is certified for the carriage of noxious liquid substances in bulk should be provided with a Procedures and Arrangements Manual

- states that the Manual identifies the arrangements and equipment needed to comply with Annex II and specifies the operational procedures with respect to
cargo handling, tank cleaning, slops handling, residue discharging, ballasting and deballasting which must be followed in order to comply with the requirements of Annex II

- states that each ship should be provided with a Cargo Record Book which should be completed, on a tank-by-tank basis, whenever any operations with respect to a noxious liquid substance take place

- states that a surveyor appointed or authorized by the Government of a Party to the Convention to supervise any operations under this Annex should make an appropriate entry in the Cargo Record Book

- describes the surveys required for ships carrying noxious liquid substances in bulk

- states that the certificate issued on satisfactory completion of the survey is an International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk

**Annex III - Harmful Substances Carried by Sea in Packaged Forms, or in Freight Containers, Portable Tanks or Road and Rail Tank Wagons**

- states that for the purpose of this annex, empty receptacles, freight containers and portable road and rail tank wagons which have been used previously for the carriage of harmful substances are treated as harmful substances themselves unless precautions have been taken to ensure that they contain no residue that is hazardous to the marine environment

- states that packaging, containers and tanks should be adequate to minimize hazard to marine environment

- describes the requirements for marking and labelling packages, freight containers, tanks and wagons

- describes the documentation relating to the carriage of harmful substances by sea

- states that certain harmful substances may be prohibited for carriage or limited as to the quantity which may be carried aboard anyone ship

- explains that jettisoning of harmful substances is prohibited except for the purpose of securing the safety of the ship or saving life at sea

**Annex IV – Sewage**

- describes the provisions regarding the discharge of sewage into the sea
**Annex V – Garbage**

- defines, for the purposes of Annex V:
  - garbage
  - nearest land
  - special area

- states that the provisions of Annex V apply to all ships

- states that the disposal into the sea of all plastics is prohibited

- states the regulations concerning the disposal of other garbage

**Annex VI – Air Pollution**

- defines, for the purposes of Annex VI:
  - describes the types of inspection required under Annex VI
  - continuous feeding
  - emission
  - new installations
  - NO\(_X\) technical code
  - Ozone depleting substances
  - sludge oil
  - shipboard incineration
  - shipboard incinerator
  - SO\(_X\) emission control area

- describes the provision for the issuance of International Air Pollution Prevention certificate

- describes the duration of validity of the certificate

- describes the regulation regarding NO\(_X\) in Regulation 13 of Annex VI

- describes the requirement for SO\(_X\) emission control area

- describes the requirement for fuel oil quality in Regulation 18 of Annex VI

3.1.1.2 **Convention of the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention) (LDC)** (2 hours)  

- explains the aims of the Convention

- defines, for the purpose of the Convention:
- dumping
- wastes or other matter
- special permit
- general permit

- states that the dumping of wastes or other matter in whatever form or condition, as listed in annex I, is prohibited
- states that the dumping of wastes or other matter listed in annex II requires a prior special permit
- states that the dumping of all other wastes or matter requires a prior general permit
- explains states that the provisions of Article IV do not apply when it is necessary to secure the safety of human life or of vessels in cases of force majeure caused by stress of weather, or in any case which constitutes a danger to human life or a real threat to vessels
- states that such dumping should be done so as to minimize the likelihood of damage to human or marine life and must be reported immediately
- states that the Addendum to Annex I contains regulations on the incineration of wastes at sea
- explains states that the appropriate authority of a Contracting Party should issue prior special or general permits in respect of matter intended for dumping:
  - loaded in its territory
  - loaded by a vessel flying its flag when the loading occurs in the territory of a State not party to the Convention

3.1.1.3 International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 (1 hour) R4
- describes the rights of Parties to the Convention to intervene on the high seas following a maritime casualty

3.1.1.4 International Convention on Civil Liability for Oil Pollution Damage, 1969 (CLC 1969) (1 hour) R4
- defines, for the purposes of the Convention:
  - ship
  - owner
  - oil
- pollution damage
- preventive measures
- incident

- describes the occurrences to which the Convention applies
- states that the owner of a ship is strictly liable for any oil pollution damage caused by the ship as the result of an incident
- lists the exceptions to liability

3.1.2 ANTI-POLLUTION PROCEDURES AND ALL ASSOCIATED EQUIPMENT

Textbooks:
Teaching aids: A1, A2, V6, V8

Required performance:

3.1.2.1 Basic knowledge of Regulation 26 Annex 1 MARPOL 73/78
- describes the key points in a typical shipboard oil pollution emergency plan

3.1.2.2 Basic knowledge of antipollution equipment required by national legislation
- for example, lists that equipment required under OPA 90 of the United States

3.2 MAINTAIN SEAWORTHINESS OF THE SHIP

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

3.2.1 STABILITY, TRIM AND STRESS TABLES, DIAGRAMS AND STRESS CALCULATING EQUIPMENT, AND ACTION TO BE TAKEN IN THE EVENT OF PARTIAL LOSS ON INTACT BUOYANCY, UNDERSTANDING OF THE FUNDAMENTALS OF WATER-TIGHT INTEGRITY

3.2.2 THE PRINCIPAL STRUCTURAL MEMBERS OF A SHIP AND THE PROPER NAMES FOR VARIOUS PARTS

3.2.1 STABILITY, TRIM AND STRESS TABLES

Textbooks: T11, T58
Teaching aids: A1, V3

Required performance:

3.2.1.1 Displacement (4 hours) R1

- states that, for a ship to float, it must displace a mass of water equal to its own mass

- explains how, when the mass of a ship changes, the mass of water displaced changes by an equal amount

- defines states that the displacement of a vessel as its mass and that it is measured in tonnes

- states that displacement is represented by the symbol Δ

- explains that a graph or scale can be drawn to show the relationship between the displacement and mean draught of a ship by using the graph or scale

  - given a displacement/draught curve, finds:
  - displacements for given mean draughts
  - mean draughts for given displacements
  - the change in mean draught when given masses are loaded or discharged
  - the mass of cargo to be loaded or discharged to produce a required change of draught

- defines 'light displacement' and 'load displacement'

- defines 'deadweight'

- uses a deadweight scale to find the deadweight and displacement of a ship at various draughts in seawater

- defines 'tonnes per centimetre immersion' (TPC)

- explains why TPC varies with different draughts

- uses a deadweight scale to obtain TPC at given draughts

  - uses TPC obtained from a deadweight to find:
  - the change of mean draught when given masses are loaded or discharged
  - the mass of cargo to be loaded or discharged to produce a required change of draught

- defines 'block coefficient' (Cb)

- calculates Cb from given displacement and dimensions
- calculates displacement from given Cb and dimensions

**3.1.1.2 Buoyancy**  (2 hours)
R1

- explains what is meant by 'buoyancy'
- defines states that the force of buoyancy as an upward force on a floating object created by the pressure of liquid on the object
- states that the buoyancy force is equal to the displacement of a floating object
- explains describes what is meant by reserve buoyancy
- explains the importance of reserve buoyancy
- explains how freeboard is related to reserve buoyancy
- explains the purpose of load lines
- explains the requirements for maintaining water tight integrity
- demonstrates an understanding of damage stability requirements for certain vessels
- explains reasons for damage stability requirements
- identifies damage stability requirements for Type A vessels, Type (B-60) and Type (B-100) vessels
- identifies equilibrium condition after flooding for Type A, and all Type B vessels
- identifies damage stability requirements for passenger vessels

**3.1.1.3 Fresh Water Allowance** (3 hours)  
R1

- explains why the draught of a ship decreases when it passes from fresh water to seawater and vice versa
- states that when loading in fresh water before proceeding into seawater, a ship is allowed a deeper maximum draught
- states that the additional draught is called describes what it meant by the fresh water allowance (FWA)
- given the FWA and TPC for fresh water, calculates the amount which can be loaded after reaching the summer load line when loading in fresh water before sailing into seawater

- describes the uses a hydrometer to find the density of dock water

- describes the effect of changes of tide and rain on dock water density

- explains how to obtain the correct dock water density

- given the density of dock water and TPC for seawater, calculates the TPC for dock water

- given the density of dock water and FWA, calculates the amount by which the appropriate load line may be submerged

- given the present draught amidships and the density of dock water, calculates the amount to load to bring the ship to the appropriate load line in seawater

### 3.1.1.3 Statical Stability

R1

- states that weight is the force of gravity on a mass and always acts vertically downwards

- states that the total weight of a ship and all its contents can be considered to act at a point called the centre of gravity (G)

- defines states that the centre of buoyancy (B) as being the centre of the underwater volume of the ship

- states that the force of buoyancy always acts vertically upwards

- explains that the total force of buoyancy can be considered as a single force acting through B

- explains states that when the shape of the underwater volume of a ship changes the position of B also changes

- states that the position of B will change when the draught changes and when heeling occurs

- labels a diagram of a midship cross-section of an upright ship to show the weight acting through G and the buoyancy force acting through B

- states that the buoyancy force is equal to the weight of the ship
- labels a diagram of a midship cross-section of a ship heeled to a small angle to show the weight acting through G and the buoyancy force acting through B

- describes stability as the ability of the ship to return to an upright position after being heeled by an external force

- defines states that the lever GZ as the horizontal distance between the vertical forces acting through B and G

- states that the forces of weight and buoyancy form a couple

- states that the magnitude of the couple is $\Delta$ displacement x lever x GZ

- explains how variations in displacement and GZ affect the stability of the ship

  - on a diagram of a heeled ship, shows:
    - the forces at B and G
    - the lever GZ

- states that the length of GZ will be different at different angles of heel

- states that if the couple $\Delta$ GZ tends to turn the ship toward the upright, the ship is stable

  - states that for a stable ship:
    - $\Delta$ x GZ is called the righting moment
    - GZ is called the righting lever

3.1.1.5 Initial Stability (4 hours)

- states that it is common practice to describe the stability of a ship by its reaction to heeling to small angles (up to approximately 10°)

- defines the transverse metacentre (M) as the point of intersection of successive buoyancy force vectors as the angle of heel increases by a small angle

- states that, for small angles of heel, M can be considered as a fixed point on the centre line on a diagram of a ship heeled to a small angle, indicates G, B, Z and M

- shows on a given diagram of a stable ship that M must be above G and states that the metacentre height GM is taken as positive

- shows that for small angles of heel ($\theta$), $GZ = GM \times \sin \theta$

- states that the value of GM is a useful guide to the stability of a ship
- describes the effect on a ship's behaviour of:
  - a large GM (stiff ship)
  - a small GM (tender ship)

- uses hydrostatic curves to find the height of the metacentre above the keel (KM) at given draughts

- states that KM is only dependent on the draught of a given ship

- given the values of KG, uses the values of KM obtained from hydrostatic curves to find the metacentre heights, GM

- states that, for a cargo ship, the recommended initial GM should not normally be less than 0.15m

**3.1.1.6 Angle of Loll** (1 hour) 

- shows that if G is raised above M, the couple formed by the weight and buoyancy force will turn the ship further from the upright

- states that in this condition, GM is said to be negative and B x GZ is called the upsetting moment or capsizing moment

- explains how B may move sufficiently to reduce the capsizing moment to zero at some angle of heel

- states that the angle at which the ship becomes stable is known as the angle of loll

- states that the ship will roll about the angle of loll instead of the upright

- states that an unstable ship may loll to either side

- explains why the condition described in the above objective is potentially dangerous

**3.1.1.7 Curves of Statical Stability** (4 hours)

- states that for anyone draught the lengths of GZ at various angles of heel can be drawn as a graph

- states that the graph described in the above objective is called a curve of statical stability

- states that different curves are obtained for different draughts with the same initial GM

- identifies cross curves (KN curves and MS curves)
- derives the formula \( GZ = MS + GM \sin \theta \)

- derives the formula \( GZ = KN - KG \sin \theta \)

- derives \( GZ \) curves for stable and initially unstable ships from \( KN \) curves
  - from a given curve of statical stability, obtains:
    - the maximum righting lever and the angle at which it occurs
    - the angle of vanishing stability
    - the range of stability

- shows how lowering the position of \( G \) increases all values of the righting lever and vice versa

- states that angles of heel beyond approximately 40° are not normally of practical interest because of the probability of water entering the ship at larger angles

3.1.1.8 Movement of the Centre of Gravity (4 hours) R1

- states that the centre of gravity (\( G \)) of a ship can move only when masses are moved within, added to, or removed from the ship
  - states that:
    - \( G \) moves directly towards the centre of gravity of added masses
    - \( G \) moves directly away from the centre of gravity of removed masses
    - \( G \) moves parallel to the path of movement of masses already on board

- calculates the movement of \( G \) (\( GG_1 \)) from:

\[
GG_1 = \frac{\text{mass added or removed} \times \text{distance of mass from } G}{\text{new displacement of the ship}}
\]

\[
GG_1 = \frac{\text{mass moved} \times \text{distance mass is moved}}{\text{displacement of the ship}}
\]

- performs calculations as in the above objective to find the vertical and horizontal shifts of the centre of gravity resulting from adding, removing or moving masses

- states that if a load is lifted by using a ship's derrick or crane, the weight is immediately transferred to the point of suspension

- states that if the point of suspension is moved horizontally, the centre of gravity of the ship also moves horizontally

- states that if the point of suspension is raised or lowered, the centre of gravity of the ship is raised or lowered
- calculates, by using moments about the keel, the position of G after loading or discharging given masses at stated positions
  - calculates the change in KG during a passage resulting from:
    - consumption of fuel and stores
    - absorption of water by a deck cargo
    - accretion of ice on decks and superstructures given the masses and their positions

### 3.1.1.9 List and its Correction (6 hours) R1

- shows on a diagram the forces which cause a ship to list when G is to one side of the centre line
- states that the listing moment is given by displacement x transverse distance of G from the centre line
- shows on a diagram that the angle of list (θ) is given by \( \tan \Theta = \frac{GG1}{GM} \), where GG1 is the transverse shift of G from the centre line
- states that in a listed condition the range of stability is reduced
- given the displacement, KM and KG of a ship, calculates the angle of list resulting from loading or discharging a given mass at a stated position, or from moving a mass through a given transverse distance
- explains with reference to moments about the centre line how the list may be removed
- given the displacement, GM and angle of list of a ship, calculates the mass to load or discharge at a given position to bring the ship upright
- given the displacement, GM and angle of list of a ship, calculates the mass to move through a given transverse distance to bring the ship upright
- given the draught, beam and rise of the floor, calculates the increase in draught resulting from a stated angle of list

### 3.1.1.10 Effect of Slack Tanks (3 hours) R1

- states that if a tank is full of liquid, its effect on the position of the ship's centre of gravity is the same as if the liquid were a solid of the same mass
- shows explains by means of diagrams how the centre of gravity of the liquid in a partly filled tank moves during rolling

- states that when the surface of a liquid is free to move, there is a virtual increase in KG, resulting in a corresponding decrease in GM

- states that the increase in KG is affected mainly by the breadth of the free surface and is not dependent upon the mass of liquid in the tank

- states that in tankers the tanks are often constructed with a longitudinal subdivision to reduce the breadth of free surface

1.11 Trim (6 hours)

- defines states that 'trim' is the difference between the draught aft and the draught forward

- states that trim may be changed by moving masses already on board forward or aft, or by adding or removing masses at a position forward of or abaft the centre of flotation

- defines states that 'centre of flotation' is the point about which the ship trims, and states that it is sometimes called the tipping centre

- states that the centre of flotation is situated at the centre of area of the waterplane, which may be forward of or abaft amidships

- demonstrates the uses hydrostatic data to find the position of the centre of flotation for various draughts

- defines states that a trimming moment as mass added or removed x its distance forward or aft of the centre of flotation; or, for masses already on board, as mass moved x the distance moved forward of aft

- defines states that the moment to change trim by 1 cm (MCT 1 cm) as the moment about the centre of flotation necessary to change the trim of a ship by 1 cm

- demonstrates the uses hydrostatic curves or deadweight scale to find the MCT 1 cm for various draughts

- given the value of MCT 1 cm, masses moved and the distances moved forward or aft, calculates the change in trim

- given the value of MCT 1 cm, the position of the centre of flotation, masses added or removed and their distances forward of or abaft the centre of flotation, calculates the change of trim
- given initial draughts and the position of the centre of flotation, extends the calculation in the above objective to find the new draughts

- given initial draughts and TPC, extends the calculation in the above objective to find the new draughts

- given initial draughts and TPC, extends the calculation to find the new draughts

- demonstrates the uses a trimming table or trimming curves to determine changes in draughts resulting from loading, discharging or moving weights

- states that in cases where the change of mean draught is large, calculation of change of trim by taking moments about the centre of flotation or by means of trimming tables should not be used

- calculates final draughts and trim for a planned loading by considering changes to a similar previous loading

### 3.1.1.12 Actions to be Taken in the Event of Partial Loss of Intact Buoyancy

(1 hour) R1

- states that flooding should be countered by prompt closing of watertight doors, valves and any other openings which could lead to flooding of other compartments

- states that cross-flooding arrangements, where they exist, should be put into operation immediately to limit the resulting list

- states that any action which could stop or reduce the inflow of water should be taken

### 3.2.2. THE PRINCIPAL STRUCTURE MEMBERS OF A SHIP

Textbooks: T58
Teaching aids: A1

Required performance:

#### 3.2.2.1.1 Ship dimensions and form (12 hours)

- illustrates the general arrangement of the following ship types:
  - general cargo
  - tankers
  - bulk carriers
  - combination carriers
  - container
  - ro-ro
  - passenger
- draws reproduces an elevation of a general cargo ship, showing holds, engine-room, peak tanks, double-bottom tanks, hatchways, tween deck and position of bulkheads

- draws reproduces an elevation of a typical crude oil carrier, showing bulkheads, cofferdams, pump-room, engine-room, bunker and peak tanks, cargo tanks, slop tank and permanent ballast tanks

- draws reproduces a plan view of a tanker, showing the arrangement of tanks

- defines and illustrates:
  - camber
  - rise of floor
  - tumblehome
  - flare
  - sheer
  - rake
  - parallel middle body
  - entrance
  - run

- defines:
  - forward perpendicular (FP)
  - after perpendicular (AP)
  - length between perpendiculars (LBP)
  - length on the waterline (LWL)
  - length overall (LOA)
  - base line
  - moulded depth, beam and draught
  - extreme depth, beam and draught

3.2.2.2 Ship Stresses (8 hours)

- describes in qualitative terms shear force and bending moments

- explains what is meant by 'hogging' and by 'sagging' and distinguishes between them

- describes the loading conditions which give rise to hogging and sagging stresses

- describes how hogging and sagging stresses are caused by the sea state

- explains how hogging and sagging stresses result in tensile or compressive forces in the deck and bottom structure
- describes water pressure loads on the ship's hull
- describes liquid pressure loading on the tank structures
- calculates the pressure at any depth below the liquid surface, given the density of the liquid
- describes qualitatively the stresses set up by liquid sloshing in a partly filled tank
- describes racking stress and its causes
- explains what is meant by 'pounding' or 'slamming' and states which part of the ship is affected
- explains what is meant by 'panting' and states which parts of the ship are affected
- describes stresses caused by localised loading
- describes corrosion
- describes the causes of corrosion on board
- describes the various methods being used to minimise the effect of corrosion

3.2.2.3 Hull structure (11 hours)

- identifies structural components on ships’ plans and drawings:
  -- frames, floors, transverse frames, deck beams, knees, brackets
  -- shell plating, decks, tank top, stringers
  -- bulkheads and stiffeners, pillars
  -- hatch girders and beams, coamings, bulwarks
  -- bow and stern framing, cant beams, breasthooks

- describes the types of materials that are used in the construction of a ship

- describes and illustrates standard steel sections:
  -- flat plate
  -- offset bulb plate
  -- equal angle
  -- unequal angle
  -- channel
  -- tee

- identifies describes with aid of sketches the longitudinal, transverse and combined systems of framing on transverse sections of ships
- sketches the arrangement of frames, webs and transverse members for each system
- illustrates double-bottom structure for longitudinal and transverse framing
- illustrates hold drainage systems and related structure
- illustrates a duct keel
- sketches the deck edge, showing attachment of sheer strake and stringer plate
- sketches a radiused sheer strake and attached structure
- describes the stress concentration in the deck round hatch openings
- explains compensation for loss of strength at hatch openings
- sketches a transverse section through a hatch coaming, showing the arrangement of coamings and deep webs
- sketches a hatch corner in plan view, showing the structural arrangements
- sketches deck-freeing arrangements, scuppers, freeing ports, open rails
- illustrates the connection of superstructures to the hull at the ship's side
- sketches a plane bulkhead, showing connections to deck, sides and double bottom and the arrangement of stiffeners
- sketches a corrugated bulkhead
- explains why transverse bulkheads have vertical corrugations and fore-and-aft bulkheads have horizontal ones
- describes the purpose of bilge keels and how they are attached to the ship's side

3.2.2.4 Bow and Stern (6 hours)
A1-p.33
- describes the provision of additional structural strength to withstand pounding
- describes and illustrates the structural arrangements forward to withstand panting
- describes the function of the sternframe
- describes and sketches a sternframe for a single-screw ship
- describes and illustrates the construction of a transom stern, showing the connections to the sternframe

3.2.2.5 Fittings (10 hours)  

- describes and sketches an arrangement of modern weather-deck mechanical steel hatches
- describes how watertightness is achieved at the coamings and cross joints
- describes the cleating arrangements for the hatches above
- describes the arrangement of portable beams, wooden hatch covers and tarpaulins
- sketches an oiltight hatchcover
- describes roller, multi-angle, pedestal and Panama fairleads
- sketches mooring bitts, showing their attachment to the deck
- sketches typical forecastle mooring and anchoring arrangements, showing the leads of moorings
- describes the construction and attachment to the deck of tension winches and explains how they are used
- describes the anchor handling arrangements from hawse pipe to spurling pipe
- describes the construction of chain lockers and how cables the bitter-ends are secured in the lockers
- explains how to secure anchors and make spurling pipes watertight in preparation for a sea passage
- describes the construction and use of a cable stopper
- describes the construction of masts and sampson posts and how they are supported at the base
- describes the construction of derricks and deck cranes
- describes the construction of bilge piping system of a cargo ship
- states that each section is fitted with a screw-down non-return suction valve
- describes and sketches a bilge strum box
- describes a ballast system in a cargo ship
- describes the arrangement of a fire main and states what pumps may be used to pressurise it
- describes the provision of sounding pipes and sketches a sounding pipe arrangement
- describes the fitting of air pipes to ballast tanks or fuel oil tanks
- describes the arrangement of fittings and lashings for the carriage of containers on deck

3.2.2.6 Rudders and Propellers (11 hours)
  A1-p.33
- describes the action of the rudder in steering a ship
- reproduces drawings of modern rudders: semi-balanced, balanced and spade
- explains the purpose of the rudder carrier and pintles
- explains how the weight of the rudder is supported by the rudder carrier
- describes the rudder trunk
- describes the arrangement of a watertight gland round the rudder stock
- explains the principle of screw propulsion
- describes a propeller and defines, with respect to it:
  -- boss
  -- rake
  -- skew
  -- face
  -- back
  -- tip
  -- radius
  -- pitch
- compares fixed-pitch with controllable-pitch propellers
- sketches the arrangement of an oil-lubricated sterntube and tailshaft
- states describes how the propeller is attached to the tailshaft
- sketches a cross-section of a shaft tunnel for water cooled and oil cooled types
- explains why the shaft tunnel must be of watertight construction and how water is prevented from entering the engine-room if the tunnel becomes flooded

3.2.2.7 Load Lines and Draught Marks (5 hours)

A1-p.33

- explains where the deck line is marked
- defines 'freeboard'
- explains what is meant by 'assigned summer freeboard'
- draws to scale the load line mark and the load lines for a ship of a given summer moulded draught, displacement and tonnes per centimetre immersion in salt water
- explains how the chart of zones and seasonal areas is used to find the applicable load line
- demonstrates how to read draughts
- explains that the freeboard, measured from the upper edge of the deck line to the water on each side, is used to check that the ship is within its permitted limits of loading
- lists the items in the conditions of assignment of freeboard
- describes why the height of sill of openings varies between different type of vessels based on Load Line Rules

3.3 PREVENT, CONTROL AND FIGHT FIRES ON BOARD

TRAINING OUTCOME:

Demonstrates a knowledge and understanding of:

3.3.1 FIRE PREVENTION
3.3.2 ORGANISING FIRE DRILLS

3.3.3 CHEMISTRY OF FIRE

3.3.4 FIRE-FIGHTING SYSTEMS

3.3.5 THE ACTION TO BE TAKEN IN THE EVENT OF FIRE, INCLUDING FIRES INVOLVING OIL

See IMO Model Course No. 2.03 and the requirements of STCW Table A-VI/3 for Competence in Advanced Fire-fighting

3.4 OPERATE LIFE SAVING APPLIANCES

TRAINING OUTCOME:

Demonstrates a knowledge and understanding of:

3.4.1 ORGANISING ABANDON SHIP DRILLS AND THE OPERATION OF SURVIVAL CRAFT AND RESCUE BOATS, THEIR LAUNCHING APPLIANCES AND ARRANGEMENTS, THEIR EQUIPMENT, INCLUDING RADIO LIFE SAVING APPLIANCES, SATELLITE EPIRBS, SARTS, IMMERSION SUITS AND THERMAL PROTECTIVE AIDS

3.4.2 SURVIVAL AT SEA TECHNIQUES

See IMO Model Course 1.23 and the requirements of STCW Table A-VI/2-1 for Competence in Survival Craft and Rescue Boats other than Fast Rescue Boats

3.5 APPLY MEDICAL FIRST AID ON BOARD

TRAINING OUTCOME:

Demonstrates a knowledge and understanding of:

3.5.1 PRACTICAL APPLICATION OF MEDICAL GUIDES AND ADVICE BY RADIO, INCLUDING THE ABILITY TO TAKE EFFECTIVE ACTION BASED ON SUCH KNOWLEDGE IN THE CASE OF ACCIDENTS OR ILLNESSES THAT ARE LIKELY TO OCCUR ON BOARD SHIP
See IMO Model Course 1.14 and the requirements of STCW Table A-VI/4-1 for Proficiency in Medical First Aids

3.6 MONITOR COMPLIANCE WITH LEGISLATIVE REQUIREMENTS

TRAINING OUTCOME:

Demonstrates a knowledge and understanding of:

3.6.1 IMO CONVENTIONS CONCERNING SAFETY OF LIFE AT SEA AND PROTECTION OF THE MARINE ENVIRONMENT

Textbooks: T19
Teaching aids: A1, A2, V4, V5, V8

Required performance:

3.6.1.1 Introduction to Maritime Law (1 hour)

- **explains** states that maritime law is based partly on generally accepted customary rules developed over many years and partly on statute law enacted by states

- states that matters of safety, protection of the marine environment and conditions of employment are covered by statute law

- states that the main sources of maritime law are international conventions

- **explains** states that the adoption of international conventions and agreements is intended to provide uniform practice internationally

- states that a convention is a treaty between the States which have agreed to be bound by it to apply the principles contained in the convention within their sphere of jurisdiction

- **explains** states that, to implement a convention or other international agreement, a State must enact national legislation giving effect to and enforcing its provisions

- **explains** states that recommendations which are not internationally binding may be implemented by a State for ships flying its flag
- lists the main originators of international conventions concerned with maritime law as are:
  - International Maritime Organisation (IMO)
  - International Labour Organisation (ILO)
  - Committee Maritime International (CMI)
  - United Nations
- describes briefly:
  - flag State jurisdiction
  - coastal State jurisdiction
  - port State jurisdiction
- describes main elements of relevant IMO Conventions, e.g. SOLAS, MARPOL and STCW
- explains the significance of the 'no more favourable treatment' clause in the SOLAS, MARPOL, STCW and ILO Minimum Standards in Merchant Ships Conventions
- distinguishes between private and public international law
- explains that public maritime law is enforced through:
  - surveys, inspection and certification
  - penal sanctions (fines, imprisonment)
  - administrative procedures (inspection of certificates and records, detention)
- states that the operation of a ship is governed by the national laws and regulations of the flag State, including those laws and regulations giving effect to international conventions
- explains that differences of detail usually exist in the national laws of different states implementing the same convention
- explains that, when serving in a ship flying a foreign flag, it is essential that the master and chief mate familiarise themselves with the laws and regulations of the flag State
- states that, when in port, a ship must also comply with the appropriate laws and regulations of the port State
- stresses the importance of keeping up to date with developments in new and amended legislation
3.6.1.2 Law of the Sea (7 hours)  

*Conventions on the Law of the Sea (0.5 hour)*


- defines describes the legal status of UNCLOS

- defines describes the legal status of the Geneva Conventions

- defines describes the pollution of the marine environment

- defines ‘dumping’

- defines ‘force majeure’

*Territorial Sea and the Contiguous Zone (2 hours)*

- describes the legal status of the territorial sea and its breadth

- defines 'internal waters'

- describes the legal status of road steads

- states describes the right of innocent passage

- defines 'passage'

- defines 'innocent passage'

- lists matters on which coastal State laws or regulations may affect innocent passage

- states describes the obligations during innocent passage in a territorial sea

- states the regarding describes the use of sea lanes and traffic separation schemes (TSS) in the territorial sea

- states describes the obligations of nuclear-powered ships and ships carrying dangerous or noxious substances

- describes the additional rights of a coastal State regarding ships proceeding to internal waters or calling at a port facility

- describes the charges which may be levied on ships passing through a territorial sea
- describes the criminal jurisdiction of a coastal State on board a foreign ship passing through the territorial sea

- explains that a coastal state may take any steps authorized by its laws for the purpose of an arrest or investigation on board a foreign ship passing through the territorial sea after leaving internal waters

- explains the coastal State’s obligation to facilitate contact between the consular authority of the flag State and the ship’s crew when taking measures to arrest a ship

- states that the coastal State may not take any steps on board a foreign ship passing through the territorial sea to arrest any person or to conduct any investigation in connection with any crime committed before the ship entered the territorial sea if the ship, proceeding from a foreign port, is only passing through the territorial sea without entering internal waters

- describes the civil jurisdiction of a coastal State on board a foreign ship passing through the territorial sea

- describes the extent of the contiguous zone and the control a coastal State may exercise therein

**International Straits (1 hour)** R8, R9

- describes the legal status of waters forming straits used for international navigation

- states the right of transit passage

- defines 'transit passage'

- states the duties of ships in transit passage

- explains the meaning of ‘generally accepted international regulations, procedures and practices'

- states the duty of ships in transit passage regarding sea lanes and TSS

- lists matters on which coastal State laws or regulations may affect transit passage

- states the obligations of ships during transit passage

- describes the application of innocent passage to straits used for international navigation
defines 'archipelago'
- defines 'archipelagic state'
- states describes the right of innocent passage through archipelagic waters
- states that an archipelagic State may designate sea lanes through its waters
- describes how sea lanes should be defined and how ships should follow them
- states that an archipelagic State may designate TSS for any sea lanes
- states that ships must respect established sea lanes and TSS
- states that the laws and regulations which may be made by an archipelagic State relating to sea lanes and the obligations of ships during their passage are the same as those relating to the transit of international straits

**Exclusive Economic Zone and Continental Shelf (0.5 hour)**

- defines the exclusive economic zone and states its breadth
- defines the continental shelf
- states describes the coastal State's jurisdiction over artificial islands, installations and structures within its exclusive economic zone
- explains the establishment of safety zones around artificial islands, installations and structures and states the breadth of those zones
- states describes the obligations of ships regarding safety zones

**High Seas (2 hours)**

- states describes the freedom of the high seas
- explains the nationality of ships
- states that each State must issue to ships to which it has granted the right to fly its flag documents to that effect
- states that, except in exceptional circumstances, ships must sail under the flag of one State only and be subject to its exclusive jurisdiction
- explains states that a ship may not change its flag during a voyage or while in a port of call, save in case of real transfer of ownership or change of registry
- explains the status of ships regarding nationality
- describes the duties of the flag State with respect to ships flying its flag
- states that in taking such measures each State is required to conform to generally accepted international standards
- states that in the event of a collision or of any other incident of navigation no penal or disciplinary proceedings may be instituted except before the judicial authorities either of the flag State or of the State of which such a person is a national
- explains who may withdraw a master's certificate or a certificate of competence or a license
- states that no arrest or detention of a ship, even as a measure of investigation, may be ordered by any authorities other than those of the flag State
- states that every State must require the master of a ship sailing under its flag, to render assistance to any person found at sea in danger of being lost, and, after a collision, to render assistance to the other ship, her crew and her passengers and, where possible, to inform the other ship of the name of his own ship, her port of registry and the nearest port at which she will call
- explains states that the breaking or injury of submarine cables so as to interrupt or obstruct telegraphic or telephonic communications, and similarly the breaking or injury of a submarine pipeline or high-voltage power cable, is, except for the purpose of saving lives or ships, a punishable offence
- states that the owners of ships who can prove that they have sacrificed an anchor, a net or any other fishing gear in order to avoid injuring a submarine cable or pipeline should be indemnified by the owner of the cable or pipeline

**Protection and Preservation of the Marine Environment (1 hour) **  
**R8, R9**

- explains the rights of coastal states to adopt laws and regulations for the prevention, reduction and control of pollution in respect of their exclusive economic zones
- summarises the enforcement by flag States of measures for the prevention, reduction and control of pollution from ships
- summarises the enforcement by port States of measures for the prevention, reduction and control of pollution from ships
- describes the measures relating to seaworthiness of vessels to avoid pollution
- summarises the enforcements by coastal States of measures for the prevention, reduction and control of pollution from ships

- states the rights of States to take and enforce measures beyond their territorial seas to avoid pollution arising from maritime casualties

- defines 'maritime casualty'


- states that UNCLOS does not alter the rights and obligations of States Parties which arise from other agreements compatible with that Convention

3.6.1.3 Safety (24 hours)

International Convention on Load Lines, 1966 (LL 1966), as amended (3 hours)

R3, R11, R12

- states that no ship to which the Convention applies may proceed to sea on an international voyage unless it has been surveyed, marked and provided with an International Load Line Certificate (1966) or an International Load Line Exemption Certificate, if appropriate

- explains to which ships the Convention applies

- states describes the duration of validity of an International Load Line Certificate (1966)

- explains the circumstances in which an International Load Line Certificate (1966) would be cancelled by the Administration

- states the control to which ships holding an International Load Line Certificate (1966) are subject when in the ports of other Contracting Governments

- defines describes for the purposes of the Regulations:
  - freeboard
  - freeboard deck
  - superstructure

- describes the position, dimensions and marking of:
  - the deck line
  - the load Line Mark
  - lines to be used with the load Line Mark
- states that the ring, lines and letters are to be painted in white or yellow on a dark ground or in black on a light ground and that they should be permanently marked on the sides of the ship

- states that the International load Line Certificate (1966) will not be delivered to a ship until the surveyor has certified that the marks are correctly and permanently indicated on the ship's sides

- defines explains the terms 'position 1' and 'position 2' with regard to the positions of hatchways, doorways and ventilators

- states that hatchway covers made of mild steel are constructed for assumed loads or not less than 1.75 tonnes/m² in position 1 and of not less than 1.30 tonnes/m² in position 2

- describes the requirements concerning the provision of closing appliances for ventilators

- states that means, permanently attached, should be provided for closing the openings of air pipes to ballast tanks and other tanks

- describes the provisions for the protection of the crew

- states that deck cargo should be so stowed as to allow for the closing of openings giving access to crew's quarters, machinery space and other parts used in the necessary work of the ship

**International Convention for the Safety of Life at Sea, 1974 as R2 amended (SOLAS) - General Provisions (2 hours)**

- states that unless expressly provided otherwise, the regulations apply only to ships engaged on international voyages

- defines 'international voyage'

- defines:
  - passenger
  - passenger ship
  - cargo ship
  - tanker
  - age of a ship

- explains who may carry out surveys for the enforcement of the provisions of SOLAS
- describes the powers of a nominated surveyor
- describes the procedures which apply if the surveyor finds that the ship does not comply with the provisions or is in such a condition that it is not fit to proceed to sea without danger to the ship or to persons on board
- lists the surveys to which a passenger ship must be subjected
- describes the extent of the surveys of passenger ships
- describes the requirements for surveys of life-saving appliances and other equipment of cargo ships, including mandatory annual surveys
- describes the requirements for surveys of radio and radar installations of cargo ships
- describes the requirements for surveys of hull, and their extent, machinery and equipment of cargo ships, including mandatory annual surveys
- states the extent of the surveys of hull, machinery and other equipment of cargo ships
- states that the condition of the ship and its equipment must be maintained to conform with the provisions of the regulations
- states that after any survey of a ship required by SOLAS, no change should be made in the structural arrangements, machinery, equipment or other items covered by the survey without the sanction of the Administration
- states that any accident to a ship or defect affecting the safety of the ship or the efficiency or completeness of the life-saving appliances or equipment should be reported to the Administration or organisation responsible for issuing the relevant certificate, who will decide whether a survey is required
- lists the surveys and their extent to which a passenger ship must be subjected
- states that an accident or defect should also be immediately reported, by the master or owner, to the appropriate authorities of the port State when the ship is in a port of another Party to the SOLAS Convention
- lists the certificates, including attachments and supplements, where appropriate, issued after survey to ships satisfying the requirements of SOLAS
- states the period of validity of each of the certificates
- states that an Exemption Certificate is not valid for longer than the period of validity of the certificate to which it refers
states that no extension of the five-year period of validity of the Cargo Ship Safety Construction Certificate is permitted

explains the circumstances under which other certificates may be extended and states the maximum extension permitted

describes the circumstances in which certificates cease to be valid

states that all certificates or certified copies of them should be posted up in a prominent and accessible place in the ship

states that certificates issued under the authority of a contracting Government should be accepted by other contracting Governments

states that a ship in the port of another Party is subject to control by officers authorized by that Government so far as verifying that the SOLAS Convention certificates are valid

describes the procedures which may be followed by officers authorised by a port State in exercising control regarding SOLAS Convention Certificates or Load Line Convention Certificates

states that the surveyor should also take into account the requirements of SOLAS reg. V/13 that all ships should be sufficiently and efficiently manned

states that, at the conclusion of a control, the master should be provided with a document giving the results of the control and details of any action taken

states that Parties to the Protocol of 1978 to the SOLAS Convention, 1974, should apply the requirements of the Convention and Protocol as may be necessary to ensure that no more favourable treatment is given to ships of non-parties to the Convention and Protocol

**SOLAS - Subdivision and Stability, Machinery and Electrical Installation (2 hours)**

defines, with reference to chapter 11-1:

- subdivision load line
- deepest subdivision load line
- length
- breadth
- draught
- bulkhead deck
- margin line
- permeability of a space
- machinery space
- passenger spaces
- weathertight
- explains what is meant by 'floodable length'
- explains what is meant by 'factor of subdivision'
- explains the application of the factor of subdivision to a passenger ship's ability to withstand the flooding of adjacent main compartments
- describes the requirements regarding unsymmetrical flooding
- states that the master should be supplied with suitable information concerning the use of cross-flooding fittings
- describes the final conditions of the ship after assumed critical damage
- states that the master should be supplied with the data necessary to maintain sufficient intact stability under service conditions to enable the ship to withstand the critical damage
- states that the conditions of stability on which the calculations of heel are based should be supplied to the master of the ship
- states that excessive heeling might result should the ship sustain damage when in a less favorable condition
- states that water ballast should not in general be carried in tanks intended for oil fuel and describes the arrangement for ships which cannot avoid putting water in oil fuel tanks
- describes the marking of subdivision load lines on passenger ships
- states that details of the subdivision load lines assigned and the conditions of service for which they are approved should be clearly indicated on the Passenger Ship Safety Certificate
- states that a ship should not be loaded so as to submerge the load line mark appropriate to the season and locality, as determined in accordance with the International Convention on load Lines, whatever the position of the subdivision load line marks may be
- states that a ship should not be loaded so as to submerge the subdivision load line mark appropriate to the particular voyage and condition of service
- classifies watertight doors as:
  - class 1 - hinged doors
  - class 2 - hand-operated sliding doors
  - class 3 - sliding doors which are power-operated as well as hand-operated
describes the provisions regarding the fitting of watertight doors in passenger ships

states that watertight doors in bulkheads dividing cargo between deck spaces must be closed before the voyage commences and must be kept closed during navigation

states that the time of opening tween-deck doors in port and the time of closing them before leaving port should be entered in the log-book

states that all watertight doors should be kept closed during navigation except when necessarily opened for the working of the ship, in which case they should always be ready to be immediately closed

states that in passenger ships carrying goods vehicles and accompanying personnel, indicators are required on the navigating bridge to show automatically when each door between cargo spaces is closed and all door fastenings are secured

states that sidescuttles, the sills of which are below the margin line, should be of such construction as will effectively prevent any person opening them without the consent of the master

states that certain sidescuttles in between-deck spaces must be closed watertight and locked before the ship leaves port and must not be opened before arrival at the next port

describes the requirements for deadlights

states that sidescuttles and deadlights which will not be accessible during navigation must be closed and secured before the ship leaves port

states that the closing and locking of sidescuttles and deadlights in spaces used alternatively for the carriage of passengers or cargo should be recorded in a log-book when carrying cargo

states the requirements for the closure of cargo loading doors in passenger ships

describes the requirements for drills, operation and inspection of watertight doors and other openings in passenger ships

states that valves, doors and mechanisms should be suitably marked to ensure that they may be properly used to provide maximum safety

lists the entries which should be made in the log-book regarding the opening and closing of doors, sidescuttles and other openings and the drills and inspections required by the regulations
states that every passenger ship and every cargo ship of 24 meters and upwards must be inclined upon its completion and the elements of its stability determined

states that the master should be supplied with such information as is necessary to obtain accurate guidance as to the stability of the ship under varying conditions of service

describes the contents of damage control plans for passenger ships

states that booklets containing the damage control information should be made available to the ship's officers

describes the recommendations on damage control for dry cargo ships

describes the indicator system which must be provided on the navigating bridge of passenger ro-ro ships to show if shell doors, loading doors and other closing appliances are not fully closed or not secured

states the requirements for the detection of water leakage through shell doors or vehicle loading doors which could lead to major flooding of special category spaces or ro-ro cargo spaces

states the requirements for ro-ro cargo spaces to be monitored whilst the ship is under way

SOLAS - Fire Protection, Fire Detection and Fire Extinction
(2 hours)

outlines the basic principles of the regulations on fire protection

explains briefly the properties of class ‘A’ and class ‘B’ divisions

defines:
- main vertical zones
- accommodation spaces
- public spaces
- service spaces
- cargo spaces
- ro-ro cargo spaces, open and closed
- special category spaces
- machinery spaces of category A
- control stations

states that fire hoses should be used only for the purposes of extinguishing fires or testing the apparatus at fire drills and surveys

describes the information included in fire control plans or booklets
- states that instructions concerning the maintenance and operation of all fire-fighting equipment and installations on board should be kept under one cover in an accessible position

- states that a duplicate set of fire control plans or booklet should be permanently stored in a prominently marked weathertight enclosure outside the deckhouse for the assistance of shoreside fire-fighting personnel

- states that all fire-extinguishing appliances must be kept in good order and available for immediate use at all times during the voyage

- states that passenger ships must at all times when at sea, or in port, be so manned or equipped that any initial fire alarm is immediately received by a responsible member of the crew

- states that a special alarm, operated from the navigating bridge or from the fire control station, should be fitted to summon the crew and should be capable of being sounded independently of the alarm to the passenger spaces

- states that an efficient patrol system must be maintained for ships carrying more than 36 passengers

- describes the training required by the fire patrol

- states that there are special requirements for ships carrying dangerous goods

- states that a ship should have a document provided by the Administration as evidence of compliance of construction and equipment with the requirements for the carriage of dangerous goods

**SOLAS - Life-Saving Appliances and Arrangements (2 hours)**

- defines, with reference to chapter III of SOLAS:
  - certificated person
  - float-free launching
  - inflatable appliance
  - inflated appliance
  - launching appliance or arrangement
  - rescue boat
  - survival craft

- states that life-saving appliances and arrangements required by chapter III of SOLAS must be approved by the Administration

- states the requirements for exhibiting muster lists
- describes the illustrations and instructions to be displayed in passenger cabins and other spaces
- lists the items to be included in muster lists and emergency instructions
- describes the provision of operating instructions for life-saving appliances
- explains how the crew should be assigned to survival craft to ensure satisfactory manning and supervision of survival craft
- states that the person in charge of a survival craft should have a list of its crew and should see that they are acquainted with their duties
- states the requirement for the provision of training manuals
- lists the items which should be contained in the training manuals
- describes the frequency of abandon ship drills and fire drills and how they should be conducted
- describes the guidelines for training crews for the purpose of launching lifeboats and rescue boats from ships making headway through the water
- describes the on-board training which should be given in the use of life-saving appliances and in survival at sea
- details the records which should be made of abandon ship drills and fire drills, other drills of life-saving appliances and on-board training
- states that before leaving port and at all times during the voyage, all life-saving appliances must be in working order and ready for immediate use
- describes the instructions for on-board maintenance of life-saving appliances which should be carried
- states describes the regulation regarding the maintenance of falls
- describes the weekly and monthly tests and inspections required and the entries which should be made in the log-book
- states describes the requirements regarding the periodic servicing of inflatable liferafts, inflatable lifejackets, inflated rescue boats and hydrostatic release gear
- states describes the requirements for passenger muster stations
- states that, on passenger ships, an abandon ship drill and a fire drill must take place weekly
defines, with reference to chapter IV of SOLAS:
- Radio Regulations
- radiotelegraph auto-alarm
- radiotelephone auto-alarm
- radiotelephone station, radiotelephone installation and watches
- radio officer
- radiotelephone operator
- emergency position-indicating radio beacon (EPIRB)

--- describes the requirements for a listening watch to be maintained on the radiotelegraph distress frequency

--- explains the circumstances in which the radio officer may discontinue listening on the radiotelegraph distress frequency

--- states that the listening periods should be maintained preferably during periods prescribed by the Radio Regulations

--- states that each ship fitted with a radiotelephone station should, while at sea, maintain continuous watch on the radiotelephone distress frequency at the place where the ship is usually navigated

--- states the requirements for the carriage of radiotelephone operators

--- states that EPIRBs should be tested, inspected and, if necessary, have their source of energy replaced at intervals not exceeding 12 months

--- states that a card of instruction giving a clear summary of the radiotelephone distress procedure should be displayed in full view of the radiotelephone operating position

--- lists the entries which should be made in the radio log for a ship fitted with a radiotelegraph station

--- lists the entries which should be made in the radio log for a ship fitted with a radiotelephone station

--- states the records which should be made concerning a VHF radiotelephone installation

--- states that radio logs should be available for inspection by officers authorized by the Administration to make such inspections

--- states that each ship fitted with a radiotelegraph station must, while at sea, maintain continuous watch on the radiotelephone distress frequency in a place determined by the Administration
states that each ship which is fitted with a VHF radiotelephone installation must, while at sea, maintain a continuous listening watch on the navigating bridge on 156.8 MHz (channel 16) or for such periods and on such channels as may be required by the Government of the area in which the ship is navigating.

states that the efficiency of the radiotelegraph auto alarm should be tested by a radio officer at least once every 24 hours while at sea; if not in working order, the fact should be reported to the master or the officer of the watch on the bridge.

states the requirements for the calibration of direction finders and the checks of the calibration which should be made.

describes the weekly test of lifeboat radiotelegraph installations.

describes the weekly test of portable radio apparatus for survival craft.

SOLAS - Radiocommunications (amended chapter IV) (2 hours)

states that the 1988 amendments to the 1974 SOLAS Convention replace the existing Chapter IV with a new Chapter IV covering the global maritime distress and safety system (GMDSS).

states that the amended Chapter IV applies to passenger ships, irrespective of size, and cargo ships of 300 tons gross tonnage and upwards engaged on international voyages.

states that every ship must comply with the regulations concerning NAVTEX and satellite EPIRB.

states that every ship constructed on or after 1 February 1995 must comply with all applicable requirements.

explains the applicability to ships built before 1 February 1995.

explains the meanings, for the purpose of the amended Chapter IV, of:
- bridge to bridge communications
- continuous watch
- digital selective calling (DSC)
- direct-printing telegraphy
- general radiocommunications
- international NAVTEX service
- locating
- maritime safety information
- polar orbiting satellite service
- sea area A1
- sea area A2
- sea area A3
- sea area A4

- states that every ship, while at sea, must be capable of:
  - transmitting ship-to-shore distress alerts by at least two separate and independent means
  - receiving shore-to-ship distress alerts
  - transmitting and receiving ship-to-ship distress alerts
  - transmitting and receiving search and rescue co-ordinating communications
  - transmitting and receiving on-scene communications
  - transmitting and receiving signals for locating
  - transmitting and receiving maritime safety information
  - transmitting and receiving general radio-communications
  - transmitting and receiving bridge-to-bridge communications

- lists the radio equipment to be carried by all ships

- describes the requirements regarding the installation and operation of the satellite EPIRB

- lists the additional equipment required by ships engaged on voyages exclusively within sea area A1

- lists the additional equipment required by ships engaged on voyages within sea areas A1 and A2

- lists the additional equipment required by ships engaged on voyages within sea areas A1, A2, and A3

- states that equipment using the INMARSAT geostationary satellite service is not an acceptable alternative for ships engaged on voyages which include sea area A4

- states the requirements for maintaining watch on distress frequencies

- states that every ship, while at sea, must maintain a watch for broadcasts of maritime safety information

- describes how the availability of radio equipment required by the regulations is to be ensured

- states that every ship must carry personnel qualified for distress and safety radio communications purposes who hold certificates specified in the Radio Regulations

- states that one person is designated to have primary responsibility for radio communications during distress incidents
- states that a record must be kept of all incidents connected with the radio communication service which appear to be of importance to the safety of life at sea

**SOLAS - Carriage of Grain (1 hour)**

Part C

- lists the intact stability requirements for a ship carrying bulk
- lists the contents of the grain loading information referred to in the document of authorization

**SOLAS - Carriage of Dangerous Goods (1 hour)**

- states that the regulations concerning the carriage of dangerous goods in packaged form or in solid bulk form apply to all ships to which the SOLAS regulations apply and to cargo ships of less than 500 gross tons
- states that the provisions do not apply to ships' stores and equipment
- states that the carriage of dangerous goods is prohibited except in accordance with the provisions of the regulations
- states that the provisions should be supplemented by detailed instructions on safe packaging and stowage, which should include the precautions necessary in relations to other cargo, issued by each Contracting Government
- classifies dangerous goods according to the IMDG code
- states that the correct technical name of goods, and not trade names, should be used in all documents relating to the carriage of dangerous goods
- states that the documents prepared by the shipper should include or be accompanied by a signed certificate or declaration that the shipment offered for carriage is properly packaged and marked and in proper condition for carriage
- states the requirements for a special list or manifest of dangerous goods on board and their location or a detailed stowage plan showing the same information
- outlines the stowage requirements for dangerous goods
- states that substances which are liable to spontaneous heating or combustion should not be carried unless adequate precautions have been taken to minimise the likelihood of the outbreak of fire
- lists the explosives which may be carried in a passenger ship

- defines:
  - International Bulk Chemical Code (IBC code)
  - Chemical tanker

- states that the regulations apply to chemical tankers constructed on or after 1 July 1986, including those of less than 500 gross tons

- states that a chemical tanker must comply with the survey requirements for a cargo ship and, in addition, be surveyed and certified as provided for in the IBC code

- states that the IBC code prescribes the design and construction standards of such ships, the equipment they should carry and marine pollution aspects

- states that the requirements of the IBC code are mandatory and subject to port State control

- defines:
  - International Gas Carrier Code (IGC code)
  - Gas carrier

**The International Safety Management (ISM) Code**

- states that a Safety Management System in compliance with the ISM Code must be in place on board all passenger ships, tankers and bulk carriers of 500gt and upwards

- states that a Safety Management System in compliance with the ISM Code must be in place on board all vessels of 500gt and upwards from 1 July 2002

- states that the details of the ship’s system may be found in the ship’s Safety Management Manual

**International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1995 (STCW) (2 hours)**

- explains the general obligations under the Convention

- defines, for the purpose of the Convention:
  - certificate
  - Certificate of Competency
- Certificate of Proficiency
- certificated
- seagoing ship
- Radio Regulations

- explains the application of the Convention
- describes the issue of certificates and their endorsement by the issuing Administration
- describes the conditions under which dispensations may be granted
- states that ships, when in a port of a party to the Convention, are subject to control to verify that all seafarers serving on board who are required to be certificated are so certificated or hold a valid dispensation
- explains that a ship which extends its voyage beyond what is defined as a near-coastal voyage by a Party must fulfill the requirements of the Convention without the relaxation allowed for near-coastal voyages
- describes the control which may be exercised by a duly authorized control officer
- describes the circumstances in which the control officer should supply written information to the master regarding deficiencies and the grounds under which the ship may be detained
- explains that the regulations contain:
  - mandatory minimum requirements for the certification of masters, officers, radiotelephone operators, able seafarers deck or engine and ratings forming part of a navigational watch or an engineering watch
  - mandatory minimum requirements for the training and qualifications of masters, officers and ratings of oil, chemical and gas tankers
  - mandatory minimum requirements to ensure the continued proficiency and updating of masters and deck, engineer and radio officers and ratings
  - basic principles to be observed in keeping navigational and engineering watches
  - mandatory minimum requirements for the issue of a Certificate of Proficiency in Survival Craft and Rescue Boats other than Fast Rescue Boats

ITU Radio Regulations (2-hours)

- states that the International Telecommunications Union (ITU) is the UN specialized agency responsible for regulations governing the use of the radio spectrum
states that the provisions concerning certificates for personnel of ship stations and ship earth stations with personnel of stations in the maritime mobile and maritime mobile-satellite service are set out in articles 55 and 56, respectively, of the Radio Regulations.

states that until 3 October 1989 articles 55 and 56 of the Radio Regulations only dealt with the:
- radio communication operator's general certificate
- first-class radiotelegraph operator's certificate
- second-class radiotelegraph operator's certificate
- radiotelegraph operator's special certificate
- general radiotelephone operator's certificate
- restricted radiotelephone operator's certificate

states that from 3 October 1989 articles 55 and 56 of the Radio Regulations also provide for the issue and use of GMDSS certificates as follows:
- first-class radio electronic certificate
- second-class radio electronic certificate
- general operator's certificate
- restricted operator's certificate

states that the conditions of issue, the knowledge and the experience required for each GMDSS certificate are set forth in article 55 of the Radio Regulations.

states that article 56 of the Radio regulations stipulates the class and minimum number of operators or personnel for ship stations and ship earth stations.

states that the provision of the Radio Regulations as amended and the provisions of the revised chapter IV of the SOLAS Convention differ with respect to maintenance requirements and requirements for carriage of personnel.

states that a number of members of the ITU made a declaration regarding the revised articles 55 and 56 of the Radio Regulations which thereby do not apply to them.

states that, although they differ, the ITU and IMO requirements are held to be compatible.

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**Special Trade Passenger Ships Agreement, 1971, and Rules, 1971 (STP 1971) (1 hour)**

- describes the application of the agreement
- defines, for the purpose of the rules:
  - Convention
  - special trades
- weather deck  
- upper deck  
- special trade passenger  
- special trade passenger ship

- explains the issue of certificates
- states that certificates or certified copies issued under this agreement should be posted in a prominent and accessible place in the ship
- explains the qualification of certificates when the number on board is less than stated in the Special Trade Passenger Ship Safety Certificate
- states describes the rule regarding the carriage of dangerous goods in special trade passenger ships
- states that ships to which the Agreement applies should comply with the International Health Regulations, having regard to the circumstances and nature of the voyage

**Protocol and Rules on Space Requirements for Special Trade Passenger Ships, 1973 (SPACE STP 1973) (1 hour)**

- describes the application of the Protocol
- explains states that a certificate called a Special Trade Passenger Ship Space Certificate is to be issued after inspection and survey of a special trade passenger ship which complies with the applicable requirements of these rules
- states that the Certificate or a certified copy of it should be posted up in a prominent and accessible place in the ship
- lists the spaces not suitable for the carriage of passengers
- states that spaces, including airing spaces, allotted for the accommodation or use of special trade passengers must be kept free of cargo
- states that ships to which the rules apply should comply with the International Health Regulations, having regard to the circumstances and nature of the voyage
- explains that the 1974 SOLAS Convention provides that special trade passenger ships may be exempted from full compliance with the requirements of chapters 11-1, 11-2 and III, provided they fully comply with the provisions of the Rules annexed to the Special Trade Passenger Ships Agreement, 1971, and to the Protocol on Space Requirements for Special Trade Passenger Ships, 1973
**Athens Convention relating to the Carriage of Passengers and their Luggage by Sea (PAL 1974) (1 hour)**

- defines, for the purposes of the Convention:
  - carrier
  - performing carrier
  - ship
  - passenger
  - luggage
  - cabin luggage
  - carriage
  - international carriage

- explains the application of the Convention

- describes when the carrier is liable for the damage suffered as a result of the death of or personal injury to a passenger and the loss of or damage to luggage

- describes the presumption of fault or neglect of the carrier, unless the contrary is proved

- explains the carrier's liability in respect of monies and valuables

- explains states that, in the case of contributory fault on the part of the passenger, the court hearing the case may exonerate the carrier wholly or partly from his liability

- states that limits of liability for personal injury and for loss of or damage to luggage are prescribed

- explains describes that if an action is brought against a servant or agent of the carrier arising out of damage covered by this Convention, such servant or agent, if he proves that he acted within the scope of his employment, will be entitled to the same defences and limits of liability as the carrier

- explains states that where entitlement to limit liability exists, the aggregate of the amounts recoverable from the carrier, or performing carrier, and a servant or agent must not exceed the prescribed limit of liability

- describes the circumstances in which the right to limit liability will be lost

- explains where an action arising under this Convention may be brought

- describes the invalidity of contractual provisions more favourable to the carrier than the provisions of this Convention
**International Convention on Tonnage Measurement of Ships, 1969**

- defines, for the purposes of the Convention:
  - international voyage
  - gross tonnage
  - net tonnage
  - new ship
  - existing ship

- explains the applications of the Convention to new and existing ships

- states that an International Tonnage Certificate (1969) will be issued to every ship, the gross and net tonnages of which have been determined in accordance with the Convention

- explains the alterations in construction or use of spaces which would lead to the cancellations of the International Tonnage Certificate

- states that a ship flying the flag of a State the Government of which is a Contracting Government is subject to inspection, when in the ports of other Contracting Governments, for the purpose of verifying that the ship is provided with a valid International Tonnage Certificate and that the main characteristics of the ship correspond to the data given in the certificate

- explains states that certain ships, required to be measured under the 1969 Tonnage Convention, may be allowed by their Administrations to use the gross tonnage as measured by the national tonnage rules in effect prior to the coming into force of the Tonnage Convention, for the application of certain provisions of the SOLAS, MARPOL and STCW Conventions

- states that the tonnage as measured by the national rules appears only on the relevant certificates required by SOLAS and MARPOL, together with an explanatory note

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**International Convention for the Control and Management of Ship’s Ballast Water and Sediments, 2004**

- defines the following:
  - ballast water
  - ballast water management
  - sediments

- describes the conditions where the application of this convention may be exempted

- describes the application of this convention

- describes the management and control requirement from Section B Regulation B1-B6
- describes the standards that need to be observed in ballast water exchange

**International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001**

- defines anti-fouling system
- describes the control of waste material in Annex 1 of the Convention

**Guidelines on the Enhanced Programme of Inspections During Surveys of Bulk Carriers and Oil Tankers**

- describes the application of the guidelines
- defines the following:
  -- overall survey
  -- close-up Survey
  -- substantial corrosion
  -- corrosion prevention system
  -- critical structure areas
  -- intermediate enhanced survey

- describes the requirement for enhanced survey carried out during periodical survey
- describes the requirement for enhanced survey carried out during annual survey
- describes the intermediate enhanced survey
- describes the preparation for survey

**1.9 LEADERSHIP AND TEAMWORK SKILLS**

**TRAINING OUTCOMES:**

Demonstrates a knowledge and understanding of:

**1.9.1 APPLICATION OF LEADERSHIP AND TEAMWORKING SKILLS**

Textbooks: T74, T75, T76
Teaching aids:

Required performance:
See IMO Model Course on Leadership and Teamwork.