ပြည်ထောင်စု သမ္မတ မြန်မာနိုင်ငံတော် အစိုးရ
ပို့ဆောင်ရေးဝန်ကြီးဌာန
ရေကြောင်းပို့ဆောင်ရေးညွှန်ကြားမှုဦးစီးဌာန

အမိန့်ကြော်ငြာစာအမှတ် ၂/၂၀၁၄

၁၃၇၅ ခုနှစ်၊ ပြာသိုလကွယ်နေ့
(၂၀၁၄ ခုနှစ်၊ ဇန်နဝါရီလ ၃၀ ရက်)

ရေယာဉ်မှူးများ၊ ရေကြောင်းအရာရှိများနှင့် ရေကြောင်းအင်ဂျင်နီယာ အရာရှိများ၏ ကျွမ်းကျင်မှုလက်မှတ်များအတွက် စာမေးပွဲသင်ရိုးညွှန်းတမ်းများ သတ်မှတ်ခြင်း

၁။ ရေကြောင်းပို့ဆောင်ရေးညွှန်ကြားမှုဦးစီးဌာနသည် မြန်မာနိုင်ငံကုန်သည်သဘော်အက်ဥပဒေ ပုဒ်မ ၂၉၄၊ ပုဒ်မခွဲ(ခ)နှင့် ရေယာဉ်မှူး၊ အရာရှိများနှင့် သဘော်သားများ၏ ကျွမ်းကျင်မှုနှင့် တတ်ကျွမ်းမှုလက်မှတ်များ ထုတ်ပေးခြင်းဆိုင်ရာ နည်းဥပဒေများ၏ အခန်း (၄)ပါ ပြဋ္ဌာန်းချက်များအရ အပ်နှင်းထားသော လုပ်ပိုင်ခွင့်ကို ကျင့်သုံး၍ ပို့ဆောင်ရေးဝန်ကြီးဌာန၏ သဘော တူညီချက်ဖြင့် ဤအမိန့်ကြော်ငြာစာကို ထုတ်ပြန်လိုက်သည်။

၂။ ရေယာဉ်မှူးများ၊ ရေကြောင်းအရာရှိများနှင့် ရေကြောင်းအင်ဂျင်နီယာ အရာရှိများ၏ အောက်ပါ ကျွမ်းကျင်မှုလက်မှတ်များအတွက် စာမေးပွဲ သင်ရိုးညွှန်းတမ်းများကို (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978 as amended including 2010 Minila Amentmends) နှင့်အညီ ယှဉ်တွဲပါ နောက်ဆက်တွဲများတွင် ဖော်ပြထားသည့်အတိုင်း သတ်မှတ်လိုက်သည် -

(က) ကုန်းပတ်အရာရှိ အဆင့် ၁ နှင့် အဆင့် ၂ကျွမ်းကျင်မှု လက်မှတ် စာမေးပွဲ သင်ရိုးညွှန်းတမ်း (Syllabus for Combined Examination of Deck Officer Class I & II Certificate of Competency) - **ANNEX (A)**

(ခ) ကုန်းပတ်အရာရှိ အဆင့် ၃ ကျွမ်းကျင်မှုလက်မှတ် စာမေးပွဲ သင်ရိုးညွှန်းတမ်း(Syllabus for Examination of Deck Officer Class III Certificate of Competency) - **ANNEX (B)**

(ဂ) ကုန်းပတ်အရာရှိ အဆင့် ၄ နှင့် အဆင့် ၅ ကျွမ်းကျင်မှုလက်မှတ် စာမေးပွဲသင်ရိုးညွှန်းတမ်း(Syllabus for Combined Examination of Deck Officer Class IV & V Certificate of Competency) - **ANNEX (C)**

(ဃ) ရေကြောင်း အင်ဂျင်နီယာအရာရှိ အဆင့် ၁ ကျွမ်းကျင်မှု လက်မှတ် စာမေးပွဲ သင်ရိုးညွှန်းတမ်း(Syllabus for Examination of Marine Engineer Officer Class I Certificate of Competency) - **ANNEX (D)**

(c) ရေကြောင်း အင်ဂျင်နီယာအရာရှိ အဆင့် ၂ ကျွမ်းကျင်မှု လက်မှတ် စာမေးပွဲ သင်ရိုးညွှန်းတမ်း(Syllabus for Examination of Marine Engineer Officer Class II Certificate of Competency) - **ANNEX (E)**

(စ) ရေကြောင်း အင်ဂျင်နီယာအရာရှိ အဆင့် ၃ ကျွမ်းကျင်မှု လက်မှတ် စာမေးပွဲ သင်ရိုးညွှန်းတမ်း(Syllabus for Examination of Marine Engineer Officer Class III Certificate of Competency) - **ANNEX (F)**

(ဆ) ရေကြောင်း အင်ဂျင်နီယာအရာရှိအဆင့် ၄ နှင့် အဆင့် ၅ ကျွမ်းကျင်မှုလက်မှတ် စာမေးပွဲ သင်ရိုးညွှန်းတမ်း (Syllabus for Conbined Examination of Marine Engineer Officer Class IV & V Certificate of Competency) - **ANNEX (G)**

(ဇ) လျှပ်စစ်နည်းပညာအရာရှိ ကျွမ်းကျင်မှုလက်မှတ် စာမေးပွဲ သင်ရိုးညွှန်းတမ်း (Syllabus for Electro-Technical Officer Certificate of Competency) - **ANNEX (H)**

၃။ ၁၄-၉-၂၀၁၂ ရက်နေ့တွင် ထုတ်ပြန်ခဲ့သော အမိန့်ကြော်ငြာစာအမှတ် (၃/၂၀၁၂) အား ဤအမိန့်ကြော်ငြာစာဖြင့် လွှမ်းမိုးပယ်ဖျက်လိုက်သည်။

(ပုံ)မောင်မောင်ဦး
ညွှန်ကြားရေးမှူးချုပ်
ရေကြောင်းပို့ဆောင်ရေးညွှန်ကြားမှုဦးစီးဌာန
ပို့ဆောင်ရေးဝန်ကြီးဌာန

ANNEX (A)

SYLLABUS FOR COMBINED WRITTEN EXAMINATION OF DECK OFFICER CLASS I & II CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation II/2)

FUNCTION: NAVIGATION AT THE MANAGEMENT LEVEL

Competence No. 1: Plan a voyage and conduct navigation

1.1 **VOYAGE PLANNING AND NAVIGATION FOR ALL CONDITIONS**

- .1 Logbooks
- .2 Navigation for
  - .1 restricted waters
  - .2 meteorological conditions
  - .3 ice
  - .4 restricted visibility
    - .1 The equipment, charts and nautical publications required for the voyage are enumerated and appropriate to the safe conduct of the voyage traffic separation schemes
    - .2 Positions, courses, distances and time calculations are correct within accepted accuracy standards for navigational equipment
  - .1 vessel traffic service (VTS) areas
  - .2 areas of extensive tidal effects

1.2 **ROUTEING IN ACCORDANCE WITH THE GENERAL PRINCIPLES ON SHIP'S ROUTEING**

- .1 Routeing

  The reasons for the planned route are supported by facts and statistical data obtained from relevant sources and publications

1.3 **REPORTING IN ACCORDANCE WITH THE GUIDELINES AND CRITERIA FOR SHIP REPORTING SYSTEMS AND WITH VTS PROCEDURES**

- .1 Ship reporting systems - All potential navigational hazards are accurately identified

Competence No. 2: Determine position and the accuracy of resultant position fix by any means

2.1 **POSITION DETERMINATION IN ALL CONDITIONS**

- .1 Terrestrial navigation
- .2 Great-circle sailing
- .3 Celestial navigation
- .4 Tides
- .5 Loran-C System
- .6 Satellite navigation system

Competence No. 3: Determine and allow for compass errors

3.1 **THE PRINCIPLES AND ERRORS OF MAGNETIC COMPASSES**

- .1 The principle and errors of magnetic compasses
- .2 Gyro-compass errors and corrections

3.2 **THE PRINCIPLES AND ERRORS OF GYRO COMPASSES**

.1 The principle and errors of gyro compasses

3.3 **SYSTEMS UNDER THE CONTROL OF THE MASTER GYRO AND THE OPERATION OF THE MAIN TYPES OF GYOR-COMPASSES IN USE AT SEA**

.1 Systems under the control of master gyro and the operation of the main types of gyro-compass in use at sea

Competence No.4: Coordinate search and rescue operations

4.1 **A THOROUGH KNOWLEDGE OF AND ABILITY TO APPLY THE PROCEDURES CONTAINED IN THE INTERNATIONAL AERONAUTICAL AND MARITIME SEARCH AND RESCUE (IAMSAR) MANUAL**

.1 The plan for coordinating search and rescue operations is in accordance with international guidelines and standards

.2 Radiocommunications are established and correct communication procedures are followed at all stages of the search and rescue operations

Competence No. 5: Establish watch-keeping arrangement and procedures

5.1 **THE INTERNATIONAL REGULATIONS FOR PREVENTING COLLISIONS AT SEA**

.1 COLREG' 72 and Amendments

5.2 **PRINCIPLES TO BE OBSERVED IN KEEPING A NAVIGATIONAL WATCH**

.1 Navigational watch

5.3 **EFFECTIVE BRIDGE TEAMWORK PROCEDURES**

.1 Bridge teamwork procedures

.2 Bridge team management

.3 Teamwork

Competence No. 6: Forecast weather and oceanographic conditions

6.1 **SYNOPTIC CHARTS AND WEATHER FORECASTING**

.1 The planetary system of wind and pressure

.2 The weather associated with the principal air mass types

.3 Synoptic and prognostic charts and forecasts from any source

.4 The maritime forecast code and the range of information available through fax transmissions

.5 The main types of floating ice, their origins and movements

.6 The guiding principles relating to the safety of navigation in the vicinity of ice

.7 Conditions leading to ice accretion on ship's superstructures, dangers and remedies available

6.2 **CHARACTERISTICS OF VARIOUS WEATHER SYSTEMS**

.1 The formation, structure and weather associated with the principal frontal systems

.2 The formation of, and weather associated with, frontal and non-frontal depressions

.3 The formation and weather characteristics of non frontal weather systems

.4 Tropical revolving storms (TRS)

6.3 **OCEAN CURRENT SYSTEMS**

.1 Surface water circulations of the ocean and principal adjoining seas

.2 The principle of voyage planning with respect to weather conditions and wave height

.3 The formation of sea waves and swell waves

6.4 **CALCULATION OF TIDAL CONDITIONS**

.1 Apply the relevant weather conditions to tidal calculations

6.5 **APPROPRIATE NAVIGATIONAL PUBLICATONS ON TIDES AND CURRENTS**

.1 Navigational publications on tides and currents

Competence No. 7: Respond to navigational emergencies

7.1 **PRECAUTIONS WHEN BEACHING A SHIP**

.1 Precautions when beaching a ship

7.2 **ACTION TO BE TAKEN IF GROUNDING IS IMMINENT AND AFTER GROUNDING**

.1 Action to be taken if grounding is imminent and after grounding

7.3 **REFLOATING A GROUNDED SHIP WITH AND WITHOUT ASSISTANCE**

.1 Refloating

7.4 **ACTION TO BE TAKEN IF COLLISION IS IMMINENT AND FOLLOWING A COLLISION OR IMPAIRMENT OF THE WATERTIGHT INTRGRITY OF THE HULL BY ANY MEANS**

.1 Collision

7.5 **ASSESSMENT OF DAMAGE CONTROL**

.1 Assessment of damage control

7.6 **EMERGENCY STEERING**

.1 Emergency steering

7.7 **EMERGENCY TOWING ARRANGEMENTS AND TOWING PROCEDURES**

.1 Emergency towing arrangements

Competence No. 8: Manoeuvre and handle a ship in all conditions

8.1 **MANOEUVRING AND HANDLING A SHIP IN ALL CONDITIONS**

.1 Approaching a pilot vessel

.2 Ship handling in restricted waters

.3 Constant rate of turn techniques

.4 Manoeuvring in shallow water

.5 Interaction: bank, canal, ship and tug

.6 Berthing and unberthing

.7 Use of propulsion and manoeuvring systems

.8 Anchoring

.9 Dry docking

.10 Handling ships in heavy weather

.11 Rescue boats and survival craft

.12 Manoeuvring and propulsion characteristics

.13 Damage due to own ship's bow and stern waves

.14 Navigating in or near ice

.15 Manoeuvring in traffic separation schemes and VTS

Competence No. 9: Operate remote controls of propulsion plant and engineering systems and services

9.1 **OPERATING PRINCIPLES OF MARINE POWER PLANTS**

9.2 **SHIPS'AUXILIARY MACHINERY**

9.3 **GENERAL KNOWLEDGE OF MARINE ENGINEERING TERMS**

.1 Marine engineering terms and fuel consumption

FUNCTION: CARGO HANDLING AND STOWAGE AT THE MANAGEMENT LEVEL

Competence No. 1: Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes

1.1 **APPLICATION OF INTERNATIONAL REGULATIONS CODES AND STANDARDS CONCERNING THE SAFE HANDLING STOWAGE, SECURING AND TRANSPORT OF CARGOES**

.1 Plans and actions conform with international regulations

1.2 **EFFECT ON TRIM AND STABILITY OF CARGOES AND CARGO OPERATIONS**

.1 Draft, trim and stability

1.3 **STABILITY AND TRIM DIAGRAMS AND STRESS CALCULATING EQUIPMENT**

.1 Shear forces, bending moments and torsional moment
.2 Compliance with minimum freeboard requirements of the Loadline regulations
.3 The use of vector diagrams to calculate stresses on Cargo gear
.4 Use of ADB equipment

1.4 **STOWAGE AND SECURING OF CARGOES ON BOARD SHIP CARGO-HANDLING GEAR AND SECURING AND LASHING EQUIPMENT**

.1 Timber deck cargoes
.2 Procedures for receiving, tallying and delivering cargo
.3 Care of cargo during carriage
.4 Requirements applicable to cargo-handling gear
.5 Maintenance of cargo gear
.6 Maintenance of hatch covers

1.5 **LOADING AND UNLOADING OPERATIONS, WITH SPECIAL REGARD TO THE TRANSPORT OF CARGOES IDENTIFIED IN THE CODE OF SAFE PRACTICE FOR CARGO STOWAGE AND SECURING**

.1 Loading, stowage and discharge of heavy weights
.2 Care of cargo during carriage
.3 Methods and safeguards when fumigating holds

1.6 **GENERAL KNOWLEDGE OF TANKERS AND TANKER OPERATIONS**

.1 Terms and definitions
.2 Contents and application of ISGOTT
.3 Oil tanker operations and related pollution-prevention regulation
.4 Chemical tankers
.5 Tank cleaning & control of pollution in chemical tankers
.6 Gas tankers
.7 Cargo operations in gas tankers

1.7 **KNOWLEDGE OF THE OPERATIONAL AND DESIGN LIMITATIONS OF BULK CARRIERS**

.1 IMDG CODE, IMSBC CODE, MARPOL 73/78 Annex III and V and other relevant information.

Competence No. 2 Assess reported defects and damage to cargo Spaces, hatch covers and ballast tanks and take Appropriate action.

2.1 **LIMITATIONS ON STRENGTH OF SHIP**

.1 Vital constructional parts of standard bulk carrier

.2 Bending moments shear forces.

2.2 **AVOIDING DETRIMENTAL EFFECTS ON BULK CARRIERS**

.1 Corrosion

.2 Fatigue and inadequate cargo handling

Competence No. 3: Carriage of dangerous cargoes

3.1 **INTERNATIONAL REGULATIONS, STANDARDS, CODES AND RECOMMENDATIONS ON CARRIAGE OF DANGEROUS CARGOES**

.1 International regulations and codes

3.2 **EFFECT ON TRIM AND STABILITY OF CARGOES AND CARGO OPERATIONS**

.1 Dangerous goods in packages

.2 Solid bulk cargoes

.3 The IMO Grain Rules

FUNCTION: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

Competence No. 1: Control trim, stability and stress

1.1 **FUNDAMENTAL PRICIPLES OF SHIP CONSTRUCTION TRIM AND STABILITY**

.1 Shipbuilding materials

.2 Welding

.3 Bulkheads

.4 Watertight and watertight doors

.5 Corrosion and its prevention

.6 Surveys and dry-docking

.7 Stability

1.2 **EFFECT ON TRIM STABILITY IN THE EVENT OF DAMAGE AND FLOODING**

.1 Effect on trim and stability of a ship in the event of damage to and consequent flooding of a compartment and countermeasures to be taken

.2 Theories affecting trim and stability

1.3 **KNOWLEDGE OF IMO RECOMMENDATIONS CONCERNING SHIP STABILITY**

.1 Responsibilities under the relevant requirements of the International Conventions and Codes

Competence No. 2: Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment.

2.1 **INTERNATIONAL MARITIME LAW EMBODIED IN INTERNATIONAL CONVENTIONS**

.1 Certificates and other documents required to be carried on board ships by international conventions

.2 Responsibilities under the relevant requirements of the International Convention on Load Lines

.3 Responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea

.4 Responsibilities under the International Convention for the Prevention of Pollution from Ships

.5 Maritime declarations of health and the requirements of the International Health Regulations

.6 Responsibilities under international instruments affecting the safety of the ship, passengers, crew and cargo

.7 Methods and aids to prevent pollution of the marine environment by ships

.8 National legislation for implementing international agreements and conventions

Competence No. 3: Maintain safety and security of the ship's crew and passengers and the operational condition of life-saving, fire fighting and other safety systems

3.1 **KNOWLEDGE OF LIFE-SAVING APPLIANCE REGULATIONS**

3.2 **ACTIONS TO BE TAKEN TO PROTECT AND SAFEGUARD ALL PERSONS ON BOARD IN EMERGENCIES**

3.3 **ACTIONS TO LIMIT DAMANGE AND SALVE THE SHIP FOLLOWING A FIRE, EXPLOSION, COLLISION OR GROUNDING**

Competence No. 4: Develop emergency & damage control plans & handle emergency situations

4.1 **PREPARATION OF CONTINGENCY PLANS FOR RESPONSE TO EMERGENCIES**

4.2 **SHIP CONSTRUCTION INCLUDING DAMAGE CONTROL**

4.3 **METHODS AND AIDS FOR FIRE PREVENTION, DETECTION AND EXTINCTION**

4.4 **FUNCTIONS AND USE OF LIFE-SAVING APPLIANCES**

Competence No. 5: Leadership and Managerial Skills

5.1 **SHIPBOARD PERSONNEL MANAGEMENT AND TRAINING**

.1 Shipboard Personnel management

.2 Organization of staff

.3 Training on board ships

5.2 **RELATED INTERNATIONAL MARITIME CONVENTIONS AND NATIONAL LEGISLATION**

.1 Related international maritime conventions and recommendations, and national legislation

5.3 **TASK AND WORKLOAD MANAGEMANT**

.1 Planning and co-ordination
.2 Personal assignment
.3 Time and resource constraints
.4 Prioritization

5.4 **EFFECTIVE RESOURCE MANAGEMENT**

.1 Allocation, assignment and prioritization of resources
.2 Effective communication on board and ashore
.3 Decisions reflect consideration of team experiences
.4 Assertiveness and leadership, including motivation.
.5 Obtaining and maintaining situational awareness

5.5 **DECISION- MAKING TECHNIQUES**

.1 Situation and risk assessment
.2 Identify and generate options
.3 Selecting course of action
.4 Evaluation of outcome effectiveness

5.6 **DEVELOPMENT, IMPLEMENTATION AND OVERSIGHT OF STANDARD OPERATING PROCEDURES**

***Competence No.6*: Organise and manage the provision of medical care on board**

6.1 **KNOWLEDGE AND USE OF MEDICAL PUBLICATIONS**

.1 International Medical Guide for ships
.2 International Code of Signals(medical section
.3 Medical First Aid Guide for Use in Accidents Involving Dangerous Goods

The following courses are required to attend as out-source training courses in addition to prescribed syllabuses for officers' training.

1. Radar / ARPA (***refers to the STCW Code Table A-II/2 & IMO Model Course 1.08 updated version***)
2. ECDIS (***refers to the STCW Code Table A-II/2 & IMO Model Course 1.27 updated version***)
3. Maneuvering & Handling of Ship with Simulator (***refers to the STCW Code Table A-II/2 & IMO Model Course 1.22 updated version***)
4. Use of leadership and managerial skill (***refers to the STCW Code Table A-II/2 & IMO Model Course 1.32 updated version***)
5. Medical Care (***refers to the STCW Code Table A-II/2 & IMO Model Course 1.15 updated version***)
6. Medical First Aid for Dangerous Goods (MFAG) (***refers to the STCW Code Table A-II/2 & IMO Model Course 1.14 updated version***)

SYLLABUS FOR ORAL EXAMINATION OF DECK OFFICER CLASS I CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation II/2)

1. NAVIGATION

1.1 Plan and Conduct Safe Navigation

.1 voyage planning and navigation for all conditions including ships' routeing and reporting systems in accordance with VTS procedures;

.2 IALA systems of Buoyage.

1.2 Forecast weather and oceanographic conditions

.1 understand and interpret a synoptic chart and use of weather routing services.;

.2 knowledge of characteristics of various weather systems, including tropical revolving storms, the avoidance of storm centres and dangerous quadrants;

.3 practical measures to be taken when navigating in or near ice and dealing with ice accumulation on board;

.4 danger messages and obligatory reporting requirements.

1.3 Establishing Safe Navigational Watch-keeping Arrangements and Procedures

.1 a thorough knowledge of the principles of navigational watch-keeping at sea, including under pilotage, at anchor and in port;

.2 a thorough knowledge of the content, application and intent of the COLREGS;

.3 knowledge and application of the ICS Bridge Procedures Guide;

.4 limitations and risks involved with the use of ECDIS and RCDS to assist command decision-making; inter-relationship and optimum of all navigational information available;

.5 specific knowledge of modern electronic navigational aids (GPS, DGPS, LORAN,GNSS, GLONASS. Galileo, AIS, LRIT, INS, IBS, VDR, SVDR, BNWAS), methods of correction and accuracy of position fixing methods;

.6 a knowledge of principles of establishing a safe engineering watch at sea, anchor and in port.

1.4 Compasses

.1 the operation and care of various types of compasses;

.2 care and maintenance of the magnetic compass and binnacle;

.3 knowledge of the purpose and use of compass correctors (candidates will not be required to demonstrate a compass correction procedure);

.4 knowledge of how to find the magnetic bearing of a distant object and subsequent construction of a deviation card.

1.5 Coordinate search and rescue operations

.1 A thorough knowledge of and ability to apply the procedures contained in the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual.

1.6 Manoeuvre the Ship

.1 knowledge of manoeuvring and propulsion characteristics of ships, with special reference to stopping distances and turning circles at various draughts and speeds, squat and inter-action;

.2 importance of navigating at reduced speed to avoid damage caused by own ship's bow wave and stern wave;

.3 demonstrate an understanding of ship manoeuvres commonly undertaken under all weather conditions including: berthing and unberthing, approaching pilot stations, restricted waters and shallow water;
.4 management and handling of ships in heavy weather;
.5 choice of anchorage and working anchors in all circumstances;
.6 precautions when manoeuvring to launch rescue boats or survival craft in bad weather.

2. CARGO HANDLING AND STOWAGE

2.1 Plan and Ensure Safe Loading, Stowage, Securing, Care During Voyage and Unloading of Cargoes

.1 knowledge and ability to apply relevant international regulations, codes ands guidelines concerning the safe handling, stowage, securing and transport of cargoes.

2.2 Assess reported defects and damage to cargo spaces hatch covers and ballast tanks and take appropriate action

.1 knowledge of the limitations on strength of the vital constructional parts of a standard bulk carrier and ability to interpret given figures for bending moments and shear forces;
.2 ability to explain how to avoid the detrimental effects on bulk carriers of corrosion, fatigue and inadequate cargo handling.

2.3 Carriage of dangerous goods

.1 International regulations, standards, codes and recommendations on the carriage of dangerous cargoes, including the lnternational Maritime Dangerous Goods (IMDG) Code and the International Maritime Solid Bulk Cargoes (IMSBC) Code;
.2 Carriage of dangerous, hazardous and harmful cargoes; precautions during loading and unloading and care during the voyage.

3. RESPONSE TO EMERGENCIES

3.1 Response to Navigational Emergencies

.1 precautions when beaching a ship;
.2 grounding: action to be taken when imminent, after grounding and re-floating, and subsequent surveys;
.3 measures to be taken following exceptional circumstances including loss of rudder and/or propeller and impairment of watertight integrity of the ship through any cause;
.4 emergency towing arrangements and towing procedures;
.5 plan and co-ordinate SAR operations, including establishing and maintaining effective communications.

3.2 Response to Other Emergencies

.1 preparation of contingency plans for response to emergencies;
.2 actions to be taken when disabled and in distress;
.3 organisation of fire and abandon ship exercises;
.4 methods and aids for fire prevention, detection and extinction;
.5 functions and use of life saving appliances;
.6 abandoning ship and survival procedure;
.7 SAR plans for passenger ships;

.8 maintenance of operational conditions of life saving appliances, fire fighting appliances and other safety systems;
.9 knowledge of the effect on trim and stability of a ship for damage control;
.10 action to limit damage and salve the ship following a fire, explosion, collision or grounding, including protection of the marine environment;
.11 action to safe guard all persons on board in emergencies;
.12 assisting a ship or aircraft in distress.

4. SHIPBOARD OPERATIONS

4.1 Compliance with Pollution Prevention Requirements

.1 responsibilities under International Convention for Prevention of Pollution including masters' duties, obligations and liabilities, including the keeping of records;
.2 methods and equipment to prevent pollution.

4.2 Seaworthiness of the Ship

.1 effect of heavy weather on the ship's structure;
.2 effect upon ship behavior of lists, stiff and tender stability conditions, large angles of heel and associated righting precautions: the effect upon different cargoes;
.3 the importance of free surface effects and the identification and correction of an angle of loll;
.4 specific effects on stability and stress caused by ship type or nature of trade.

4.3 Use of Leadership and Managerial Skill

.1 knowledge of personnel management, organisation and training including disciplinary procedures;
.2 ability to apply task and workload management;
.3 knowledge and ability to apply effective resource management;
.4 knowledge and ability to apply decision-making techniques
.5 application of hours of work and rest legislation.

4.4 Maintain Safety of Ships Crew and Passengers

.1 manage to maintain safe engineering watch
.2 master's responsibility with respect to stowaways and prevention of smuggling;
.3 precautions to safeguard against terrorism, piracy and armed robbery;
.4 methods of pest control, fumigation of holds and living spaces, safeguards in applying various methods;
.5 Organize and manage the provision of medical care on board:
  .1 International Medical Guide for Ships or equivalent national publications;
  .2 medical section of the International Code of Signals;
  .3 Medical First Aid Guide for Use in Accidents Involving Dangerous Goods.

4.5 Legislative Requirements

.1 knowledge and application of Myanmar Merchant Shipping Act, including the Code of Safe Working Practices for Merchant Seamen and the main elements of Risk Assessment;
.2 safe manning, crew agreements, conditions of employment, official log book and the law relating to entries;
.3 knowledge of international conventions relevant to the operation of ships, including certificates and other documents required to be carried on board ships;
.4 knowledge of international conventions relevant to maritime safety, security and marine environment;

.5 requirements for statutory and classification surveys;
.6 reports required by the Marine Accident Investigation Branch (MAIB);
.7 putting into port with damage to ship and/or cargo, both from business and technical points of view, safeguarding of cargo;
.8 towage and salvage agreements;
.9 obligations with respect to pilotage;
.10 dealing with Flag State and Port State Control;
.11 maritime declarations of health and requirements of the international health regulations;
.12 purpose and application of the International Safety Management (ISM) Code and ISPS Code.

SYLLABUSES FOR ORAL EXAMINATION
DECK OFFICER CLASS II
CERTIFICATE OF COMPETENCY
(Under STCW Convention, Regulation II/2)

1. NAVIGATION

1.1 Plan and Conduct Safe Navigation

.1 passage planning with respect to the use of navigational publications including navigational charts (including ECDIS and RCDS), sailing directions, light lists, tide tables, radio navigational warnings and ships' routeing information;

.2 the requirements of ship routeing and mandatory reporting systems and VTS procedures;

.3 IALA systems of buoyage;

.4 electronic navigational systems - limitations and sources of error, methods of correction;

.5 radar and ARPA - practical use of, modes of operation, limitations, sources of error and parallel indexing;

.6 specific knowledge of modern electronic navigational aids (GPS, DGPS, LORAN,GNSS, GLONASS. Galileo, AIS, LRIT, INS, IBS, VDR, SVDR, BNWAS), methods of correction and accuracy of position fixing methods;

.7 sources of meteorological information, ability to use and interpret information obtained from ship borne meteorological instruments, (the instruments supplied by the Meteorological Office will be taken as standard), knowledge of characteristics of various weather systems, reporting and recording systems.

1.2 Establishing Safe Navigational Watch-keeping Arrangements and Procedures

.1 a thorough knowledge of the principles of navigational watch-keeping at sea, including under pilotage, and watch-keeping at anchor and in port;

.2 a thorough knowledge of the content, application and intent of the International Regulations for Preventing Collisions at Sea;

.3 conduct in and near traffic separation schemes and vessel traffic service (VTS) areas;

.4 understand the use of bridge equipment, including rate of turn indicators, course recorders, echo sounders and NAVTEX;

.5 knowledge of steering control systems, including automatic pilot, operational procedures and change-over from manual to automatic control and vice-versa, adjustment of controls for optimum performance;

.6 knowledge and application of the ICS Bridge Procedures Guide;

.7 a knowledge of principles of establishing a safe engineering watch at sea, anchor and in port.

1.3 Compasses

.1 use, care and limitations of the magnetic and gyro compasses, and associated equipment including automatic pilot.

1.4 Coordinate search and rescue operations

.1 A thorough knowledge of and ability to apply the procedures contained in the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual.

1.5 **Manoeuvre the Ship**

.1 conning the ship, effects of wind and current, effects of dead-weight, draft, trim, speed and under-keel clearance on turning circles and stopping distances; interaction and squat;

.2 berthing and unberthing at jetties, quays, mooring buoys and single-point moorings with/without tugs, with/without tidal stream, with/without wind;

.3 manoeuvres in restricted waters and open ocean waters;

.4 embarking and disembarking pilots;

.5 limitations of remote control operation of marine power plant and auxiliary machinery;

.6 anchors: different types of anchors and their advantages and disadvantages, preparation for anchoring, anchoring in a tideway and in confined water, operation of anchoring with a single anchor and use of a second anchor, dragging anchor, clearing a foul anchor and hawse, hanging off an anchor, breaking and slipping cables, getting under way;

.7 navigation in the vicinity of ice, ice reporting and steps to be taken in the event of ice accretion;

.8 manoeuvres to launch and recover rescue boats/survival craft.

2. CARGO HANDLING AND STOWAGE

2.1 **Loading and Unloading of Cargoes**

.1 use, maintenance and testing of cargo handling equipment on board the vessel concerned;

.2 application of the contents of relevant codes and guidelines concerning the safe handling of cargoes on board the vessel concerned;

.3 knowledge of the effect on trim and stability, of cargoes and cargo operations on board the vessel concerned;

.4 use of stability and trim information, use of stress-calculating equipment, knowledge of loading cargoes and ballasting with respect to stability and hull stress.

2.2 **Stowage, Securing and Care of Cargoes**

.1 application of the contents of relevant regulations, codes and guidelines concerning the safe stowage, securing and carriage of cargoes.

2.3 **Assess reported defects and damage to cargo spaces hatch covers and ballast tanks and take appropriate action**

.1 knowledge of the limitations on strength of the vital constructional parts of a standard bulk carrier and ability to interpret given figures for bending moments and shear forces;

.2 ability to explain how to avoid the detrimental effects on bulk carriers of corrosion, fatigue and inadequate cargo handling.

2.4 **Carriage of dangerous goods**

.1 International regulations, standards, codes and recommendations on the carriage of dangerous cargoes, including the lnternational Maritime Dangerous Goods (IMDG) Code and the International Maritime Solid Bulk Cargoes (IMSBC) Code;

.2 Carriage of dangerous, hazardous and harmful cargoes; precautions during loading and unloading and care during the voyage.

3. RESPONSE TO EMERGENCIES

3.1 Response to Navigational Emergencies

.1 measures to be taken following: accidental damage including collision, grounding, flooding or major mechanical damage, including the possibility of beaching a ship; protection of the marine environment;

.2 knowledge of the effect on trim and stability, and subsequent actions in the event of damage to and consequent flooding of a compartment;

.3 preparations and precautions for towing and being towed;

.4 use of the International Aeronautical and Marine Search and Rescue (IAMSAR) Manual (Volume III), distress and emergency signals; Search and Rescue (SAR) worldwide;

.5 SAR and rescue plans for passenger ships;

.6 knowledge of the operation of emergency steering systems.

3.2 Response to Other Emergencies

.1 the organisation and direction of fire-fighting and abandon ship parties;

.2 methods of dealing with fire on board ship; prevention of fire at sea and in port;

.3 action to be taken to prevent the spread of fire;

.4 operation, maintenance and testing of fire fighting equipment, fire doors, dampers, screens and detection equipment;

.5 operation, maintenance and testing of watertight doors, sidescuttles and scuppers;

.6 launch, manage and ensure survival in survival craft, recover survival craft at sea and beach or land survival craft;

.7 operation, maintenance and testing of lifesaving appliances;

.8 knowledge of the contents of SOLAS training manuals;

.9 action to be taken when disabled and in distress;

.10 assisting a ship or aircraft in distress; rescuing the passengers and crew of a disabled ship or ditched aircraft;

.11 safety during helicopter operations.

3.3 Communications

.1 correct use of distress signals and awareness of penalties for misuse;

.2 emergency communications within the GMDSS regulations;

.3 sources of radio medical advice.

4. SHIPBOARD OPERATIONS

4.1 Compliance with Pollution Prevention Requirements

.1 measures to be taken to prevent pollution in port and at sea;

.2 take appropriate action in response to pollution incidents on board and found at sea;

.3 knowledge of the contents of the SOPEP manual, Garbage Management Plan and use of provided anti-pollution equipment;

.4 practical knowledge of the requirements of MARPOL Conventions;

.5 knowledge of responsibilities, duties, obligations and liabilities in respect of pollution.

4.2 Seaworthiness of the Ship

.1 preparations for sea prior to sailing with respect to watertight integrity and additional precautions to be taken before the onset of heavy weather;

.2 practical knowledge of the particular loadline items affecting seaworthiness;

.3 action in event of cargo shift, damage to hull or hatches, loss of cargo overboard or ingress of water into hull;

.4 preparation for dry-docking and undocking with and without cargo/damage; general procedure and precautions to be observed;

.5 use and care of deck machinery commonly fitted.

4.3 **Crew Management**

.1 knowledge of personnel management, organisation and training including disciplinary procedures;

.2 application of hours of work and rest legislation.

4.4 **Maintain Safety of Ships Crew and Passengers**

.1 master's responsibility with respect to stowaways and prevention of smuggling;

.2 precautions to safeguard against terrorism, piracy and armed robbery;

.3 methods of pest control - fumigation of holds and living spaces; safeguards in applying various methods.

4.5 **Legislative Requirements**

.1 knowledge of the application of Myanmar Merchant Shipping Act, including the Code of Safe Working Practices for Merchant Seamen and the main elements of Risk Assessment;

.2 Improvement and Prohibition Notices;

.3 safe manning, crew agreements, conditions of employment, official log book and the law relating to entries;

.4 understanding of load line marks, entries and reports in respect of freeboard, draft and allowances;

.5 routine inspection of living quarters and store rooms, and complaints procedure;

.6 requirements for records including Oil Record Book;

.7 requirements for drills and training;

.8 the requirements of the regulations concerning fire-fighting appliances;

.9 knowledge of the requirements of the regulations concerning life-saving appliances;

.10 knowledge of the international conventions relevant to the operation of ships including certificates and other documents required to be carried on board ships;

.11 requirements for statutory and classification surveys;

.12 reports required by the Marine Accident Investigation Branch (MAIB);

.13 putting into port with damage to ship and/or cargo, both from business and technical points of view - safeguarding of cargo;

.14 obligations with respect to pilotage;

.15 towage and salvage agreements;

.16 purpose of Flag State and Port State Control;

.17 purpose and application of the International Safety Management (ISM) Code and ISPS Code.

ANNEX (B)

SYLLABUS FOR WRITTEN EXAMINATION OF DECK OFFICER CLASS III CERTIFICATE OF COMPETENCY COURSE

(Under STCW Convention, Regulation II/1)

FUNCTION - NAVIGATION AT OPERATION LEVEL

Competence No. 1: Plan and conduct a passage and determine position

1.1 **CELESTIAL NAVIGATION**

- .1 Solar system
- .2 Celestial sphere and equinoctial system of co-ordinates
- .3 Hour angle
- .4 Daily motion and horizontal system of co-ordinates
- .5 Sextant and altitude corrections
- .6 Amplitude
- .7 Time and equation of time
- .8 Nautical Almanac
- .9 Latitude by meridian altitude
- .10 Pole Star observations
- .11 Position fixing

1.2 **TERRESTRIAL AND COASTAL NAVIGATION**

- .1 Definitions — Earth
- .1 Charts
- .4 Datums
- .5 Distances
- .6 Position lines and positions
- .7 Sailings
- .8 Chart work exercises
- .9 Information from charts, lists of lights and other publications
- .10 Tides
- .11 Keeping a log

1.3 **ELECTRONIC SYSTEM OF POSITION FIXING AND NAVIGATION**

- .1 Basic principles of hyperbolic navigation systems
- .2 Loran-C system
- .3 Satellite navigation systems
- .4 GPS

1.4 **ECHO-SOUNDER AND SPEED MEASUREMENT**

- .1 Echo-sounders
- .2 Speed logs

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

1.6 **STEERING AND CONTROL SYSTEMS**

.1 The automatic pilot

.2 Fluxgate Compass

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

Competence No. 2: Maintain a safe navigational watch

2.1 **WATCHKEEPIN**

.1 **KNOWLEDGE OF THE COLLISION REGULATIONS**

.1 Content, application and intent of COLREG '72

Lights, shapes and sound signals conform with the requirements contained in the International Regulations for Preventing Collisions at Sea, 1972, as amended, and are correctly recognized

2.2 **PRINCIPLES IN KEEPING A NAVIGATIONAL WATCH**

.1 Principles to be observed in keeping a navigational watch

The conduct, handover and relief of the watch conforms with accepted principles and procedures.

A proper lookout is maintained at all times and in such a way as to conform to accepted principles and procedures

.2 Keeping a watch in port

2.3 **THE USE OF ROUTEING**

.1 Weather routeing

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

2.4 **THE USE OF INFORMATION FROM NAVIGATIONAL EQUIPMENT FOR MAINTAINING A SAFE NAVIGATIONAL WATCH**

.1 Use of Navigational Equipments

2.5 **KNOWLEDGE OF BLIND PILOTAGE TECHNIQUES**

.1 Responsibility for the safety of navigation is clearly defined at all times, including periods when the master is on the bridge and while under pilotage

2.6 **THE USE OF REPORTING IN ACCORDANCE WITH THE GENERAL PRINCIPALS FOR SHIP REPORTING SYSTEMS AND WITH VTS PROCEDURES.**

.1 The frequency and extent of monitoring of traffic, the ship and the environment conform with accepted principles and procedures.

.2 A proper record is maintained of the movements and activities relating to the navigation of the ship.

2.7 **EFFECTIVE BRIDGE TEAMWORK PROCEDURES**

2.7.1 Bridge teamwork procedures

Competence No. 3: Respond to emergencies

3.1 **EMERGENCY PROCEDURES**

.1 **PRECAUTIONS FOR PROTECTION AND SAFETY OF PASSENGERS AND EMERGENCY SITUATIONS**

.1 Contingency plans for response to emergencies

.2 Precautions for protection and safety of passengers in emergency situations

3.2 **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 salving 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

3.3 **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

Competence No. 4: Respond to a distress signal at sea

4.1 **SEARCH AND RESCUE**

.1 IAMSAR

Competence No.5: English language

See Course under English Department

Competence No. 6: Transmit and receive information by visual signaling

6.1 **TRANSMIT AND RECEIVE SIGNALS BY MORSE LIGHT**

.1 Signaling by Morse Code

6.2 **USE THE INTERNATIONAL CODE OF SIGNALS**

.1 International Code of Signals

Competence No. 7: Manoeuvre the ship

7.1 **SHIP MANOEUVRING AND HANDLING**

.1 Turning circles and stopping distances
.2 Effect of wind and current on ship handling
.3 Manoeuvres for rescue of person overboard
.4 Squat, shallow water and similar effects
.5 Proper procedures for anchoring and mooring

FUNCTION: CARGO HANDLING AND STOWAGE AT THE OPERATIONAL LEVEL

Competence No. 1: Monitor the loading, stowage, securing and unloading of cargoes and their care during the voyage

1.1 **CARGO HANDLING, STOWAGE AND SECURING**

.1 The effect of cargo, including heavy lifts on the sea-worthiness and stability of the ship
  .1 Draught, trim and stability
  .2 Securing cargoes
  .3 Deck cargo
  .4 Container cargo
  .5 Bulk cargo
  .6 Bulk grain cargo

1.2 **SAFE HANDLING, STOWAGE AND SECURING OF CARGOES**

.1 Cargo care Dangerous, hazardous and harmful cargoes
.2 Cargo handling equipment and safety
.3 Oil tanker piping and pumping arrangements
.4 Precautions before entering enclosed or contaminated spaces
.5 Cargo calculations and cargo plans

Competence No. 2: INSPECT AND REPORT DEFECTS AND DAMAGE TO CARGO SPACES, HATCH COVERS AND BALLAST TANKS

2.1 **KNOWLEDGE ABILITY TO EXPLAIN WHERE TO LOOK FOR DAMAGE AND DEFECTS MOST COMMONLY ENCOUNTERED DUE TO**:

.1 loading and unloading operations
.2 corrosion
.3 severe weather conditions

2.2 **ABILITY TO STATE WHICH PARTS OF THE SHIP SHALL BE INSPECTED EACH TIME IN ORDER TO COVER ALL PARTS WITHIN A GIVEN PERIOD OF TIME**

.1 The inspections are carried out in accordance with laid-down procedures.
.2 Defects and damage are detected and properly reported.
.3 Where no defects or damage are detected, the evidence from testing and examination clearly indicates adequate competence in adhering to procedures and ability to distinguish between normal and defective or damaged parts of the ship.

2.3 **IDENTIFY THOSE ELEMENTS OF THE SHIP STRUCTURE WHICH ARE CRITICAL TO THE SAFETY OF THE SHIP**

2.4 **STATE THE CAUSES OF CORROSION IN CARGO SPACES AND BALLAST TANKS AND HOW CORROSION CAN BE IDENTIFIED AND PREVENTED.**

2.5 **PROCEDURES ON HOW THE INSPECTIONS SHALL BE CARRIED OUT.**

2.6 **HOW TO ENSURE RELIABLE DETECTION OF DEFECTS AND DAMAGES.**

2.7 **THE PURPOSE OF THE "ENHANCED SURVEY PROGRAMME"**

FUNCTION: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE OPERATIONAL LEVEL

Competence No. 1: Ensure compliance with pollution prevention requirements

1.1 **THE PRECAUTIONS TO BE TAKEN TO PREVENT POLLUTION OF THE MARINE ENVIORMENT**
- .1 MARPOL 73/78

1.2 **ANTI-POLLUTION PRODUCERS AND ASSOCIATED EQUIPMENT**
- .1 Regulation 26- Annex 1 MARPOL 73/78
- .2 Anti-Pollution Equipment

Competence No. 2: Maintain the sea-worthiness of the ship

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

2.2 **SHIP CONSTRUCTION** Ship dimensions and form
- .1 Ship Stresses
- .2 Hull structure
- .3 Bow and stem
- .4 Fittings
- .5 Rudders and propellers
- .6 Load lines and draught marks

Competence No. 3: Monitor compliance with legislative requirements

3.1 **BASIC WORKING KNOWLEDGE OF THE RELEVANT IMO CONVENTIONS CONCERNING SAFETY OF LIFE AT SEA AND PROTECTION OF THE MARINE ENVIRONMENT**
- .1 International Convention on Load Lines 1966
- .2 SOLAS, 1974 as amended
- .3 SOLAS-Subdivision and stability
- .4 SOLAS-Fire protection, detection and extinction
- .5 SOLAS-LSA and arrangements (LSA Code)
- .6 SOLAS-radiotelegraphy and R/T
- .7 SOLAS-Radio communications (amended Chap. IV)

.8 SOLAS-Carriage of grain
.9 SOLAS-Carriage of dangerous goods
.10 STCW, 2010
.11 ITU Radio regulations
.12 STP ships Agreement, 1971
.13 SPACE STP, 1973
.14 PAL, 1974 and Tonnage 1969
.15 MARPOL 73/78

Competence No. 4: Leadership and Managerial Skills

4.1 **SHIPBOARD PERSONNEL MANAGEMENT AND TRAINING**

.1 Shipboard Personnel management
.2 Organization of staff
.3 Training on board ships

4.2 **RELATED INTERNATIONAL MARITIME CONVENTIONS AND NATIONAL LEGISLATION**

.1 Related international maritime conventions and recommendations, and national legislation

4.3 **TASK AND WORKLOAD MANAGEMANT**

.1 Planning and co-ordination
.2 Personal assignment
.3 Time and resource constraints
.4 Prioritization

4.4 **EFFECTIVE RESOURCE MANAGEMENT**

.1 Allocation, assignment and prioritization of resources
.2 Effective communication on board and ashore
.3 Decisions reflect consideration of team experiences
.4 Assertiveness and leadership, including motivation.
.5 Obtaining and maintaining situational awareness

4.5 **DECISION- MAKING TECHNIQUES**

.1 Situation and risk assessment
.2 Identify and generate options
.3 Selecting course of action
.4 Evaluation of outcome effectiveness

4.6 **DEVELOPMENT, IMPLEMENTATION AND OVERSIGHT OF STANDARD OPERATING PROCEDURES**

Competence No. 5: Safety of personal and ship

5.1 **PERSONAL SURVIVAL TECHNIQUES**
5.2 **FIRE PREVENTION AND ABILITY TO FIGHTAND EXTINGUISH FIRES**
5.3 **ELEMENTARY FIRST AID**
5.4 **PERSONAL SAFETY AND SOCIAL RESPONSIBILITIES**

The following courses are required to attend as out-source training courses in addition to prescribed syllabuses for officers' training.

1. Radar / ARPA (***refers to the STCW Code Table A-II/1 & IMO Model Course 1.07 updated version***)
2. ECDIS (***refers to the STCW Code Table A-II/1 & IMO Model Course 1.27 updated version***)
3. Use of leadership and team working skills (***refers to the STCW Code Table A-II/1***)
4. Medical First Aid (***refers to the STCW Code Table A-II/1 & IMO Model Course 1.14 updated version***)
5. Safety of personnel and ship (4 tickets) personnel survival technique, fire fighting and extinguishing. Elementary First Aid. Personnel safety and social responsibilities. (***refers to the STCW Code Table A-II/1 & IMO Model Course 1.13, 1.19, 1.20 and 1.21 updated version***)

SYLLABUSES FOR ORAL EXAMINATION OF DECK OFFICER CLASS III CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation II/1)

1. NAVIGATION

1.1 Plan and Conduct a Passage Including Position Determination

.1 passage planning with respect to the use of navigational publications including navigational charts (including ECDIS and RCDS), sailing directions, light lists, tide tables, radio navigational warnings and ships' routeing information;

.2 the requirements of ship routeing and mandatory reporting systems;

.3 IALA systems of buoyage;

.4 electronic navigational systems - limitations and sources of error, methods of correction;

.5 limitations of electronic chart systems including ECDIS and RCDS navigational chart systems;

.6 radar and ARPA - practical use of, modes of operation, limitations, sources of error and parallel indexing;

.7 to use an azimuth mirror for taking bearings, including the determination of compass errors;

.8 to use a sextant, identify and correct errors;

.9 sources of meteorological information, ability to use and interpret information obtained from ship borne meteorological instruments (the instruments supplied by the Meteorological Office will be taken as standard), knowledge of characteristics of various weather systems, reporting and recording systems.

1.2 Maintain a Safe Navigational Watch

.1 a thorough knowledge of the principles of navigational watch-keeping at sea, including under pilotage, and watch-keeping at anchor and in port;

.2 a thorough knowledge of the content, application and intent of the International Regulations for Preventing Collisions at Sea;

.3 knowledge of bridge resource management principles;

.4 radar and ARPA - practical use of, modes of operation, limitations, sources of error, plotting and parallel indexing;

.5 understand the use of bridge equipment, including rate of turn indicators, course recorders, echo sounders and NAVTEX;

.6 knowledge of steering control systems, including automatic pilot, operational procedures and change-over from manual to automatic control and vice-versa - adjustment of controls for optimum performance;

.7 knowledge and application of the ICS Bridge Procedures Guide.

1.3 Compasses

.1 use, care and limitations of the magnetic and gyro compasses, and associated equipment, including automatic pilot.

1.4 **Manoeuvre the Ship**

.1 preparation for getting under way, duties prior to proceeding to sea, making harbour, entering a dock, berthing alongside quays, jetties, or other ships, and securing to buoys;

.2 use and care of mooring lines and associated equipment;

.3 helm orders, conning the ship, effects of propellers on the steering of a ship, effects of wind and current, stopping, going astern, turning short round, interaction and squat, manoeuvring in the vicinity of pilot vessels and other craft, embarking and disembarking a pilot;

.4 action in event of failure of:- bridge control, telegraph or steering; emergency steering arrangements;

.5 manoeuvres and procedures for the rescue of person overboard;

.6 proper procedures for anchoring.

2. CARGO HANDLING AND STOWAGE

2.1 Loading and Unloading of Cargoes

.1 use and care of synthetic fibre and wire ropes, ascertaining of safe-working loads;

.2 knowledge of 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;

.3 knowledge and ability to explain where to look for damage and defects most commonly encountered due to:

.4 loading and unloading operations;

.5 corrosion;

.6 severe weather corrosion.

.7 use of the hydrometer.

3. RESPONSE TO EMERGENCIES

3.1 **Response to Navigational Emergencies**

.1 initial action following: man overboard, collision, grounding, flooding or major mechanical damage, and receipt of a distress message; initial damage assessment and control, protection of the marine environment;

.2 precautions for the protection and safety of passengers in emergency situations;

.3 use of the International Aeronautical and Marine Search and Rescue (IAMSAR) Manual (Volume III), distress and emergency signals; Search And Rescue worldwide.

3.2 **Response to Other Emergencies**

.1 understanding of the organisational procedures for emergency parties and drills;

.2 knowledge of fire prevention, use and care of fire-fighting appliances, the shut-down and isolation of plant and equipment, escape and breathing apparatus, fire and safety plans;

.3 knowledge of classes and chemistry of fire;

.4 understanding of action to be taken in the event of fire including fires involving oil;

.5 use and care of life-saving appliances and equipment including hand held radios, EPIRBs, SARTs, immersion suits and thermal protective aids, and rocket line throwing apparatus;
.6 meaning of markings on survival craft and associated equipment;
.7 correct use of distress signals and awareness of penalties for misuse;
.8 launch and manage survival craft, recover rescue boats at sea;
.9 precautions for the protection and safety of passengers in emergencies;
.10 knowledge of the contents of SOLAS training manuals and maintenance logs;
.11 basic principles of survival;
.12 appreciation of action to be taken when emergencies arise in port;
.13 sources of medical information available.

3.3 **Communications**

.1 use of distress and emergency signals, International Code of Signals and the IMO Standard Marine Communication Phrases;
.2 emergency communications within the GMDSS regulations.

4. SHIPBOARD OPERATIONS

4.1 **Pollution Prevention Requirements**

.1 precautions to be taken to prevent pollution of the marine environment as required by the MARPOL conventions, including Restricted Areas and the disposal of pollutants;
.2 basic understanding of the SOPEP manual, Garbage Management Plan and anti-pollution equipment.

4.2 **Seaworthiness of the Ship**

.1 understand fundamentals of watertight integrity, and the closing of all openings including hatch covers, access hatches and watertight doors;
.2 preparations for heavy weather.

4.3 **Legislative Requirements**

.1 contents and use of Merchant Shipping Notices, Annual Summary and Admiralty Notices to Mariners;
.2 knowledge and application of current Merchant Shipping Act, and the Code of Safe Working Practices for Merchant Seamen;
.3 basic knowledge of relevant IMO conventions concerning safety of life at sea, and protection of the marine environment;
.4 purpose and application of the International Safety Management (ISM)Code and ISPS Code;
.5 purpose of Flag State and Port State Control;
.6 application of leadership and team-working skills.

ANNEX (C)

SYLLABUS FOR COMBINED WRITTEN EXAMINATION OF DECK OFFICER CLASS IV & V CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation II/2)

FUNCTION: NAVIGATION AT THE MANAGEMENT LEVEL

Competence No. 1: Plan a voyage and conduct navigation

1.1 **VOYAGE PLANNING AND NAVIGATION FOR ALL CONDITIONS**

- .1 Logbooks
- .2 Navigation for
  - .1 restricted waters
  - .2 meteorological conditions
  - .3 restricted visibility
    - .1 The equipment, charts and nautical publications required for the voyage are enumerated and appropriate to the safe conduct of the voyage traffic separation schemes
    - .2 Positions, courses, distances and time calculations are correct within accepted accuracy standards for navigational equipment
  - .4 vessel traffic service (VTS) areas
  - .5 areas of extensive tidal effects

1.2 **ROUTEING IN ACCORDANCE WITH THE GENERAL PRINCIPLES ON SHIP'S ROUTEING**

- .1 Routeing

  The reasons for the planned route are supported by facts and statistical data obtained from relevant sources and publications

1.3 **REPORTING IN ACCORDANCE WITH THE GUIDELINES AND CRITERIA FOR SHIP REPORTING SYSTEMS AND WITH VTS PROCEDURES**

- .1 Ship reporting systems - All potential navigational hazards are accurately identified

***Competence No. 2*: Determine position and the accuracy of resultant position fix by any means**

2.1 **POSITION DETERMINATION IN ALL CONDITIONS**

- .1 Terrestrial navigation
- .2 Celestial navigation
- .3 Tides
- .4 Satellite navigation system

***Competence No. 3*: Determine and allow for compass errors**

3.1 **THE PRINCIPLES AND ERRORS OF MAGNETIC COMPASSES**

- .1 Parts of the magnetic compass and their function.

3.2 **THE PRINCIPLES AND ERRORS OF GYRO COMPASSES**

- .1 The principle and errors of gyro compasses
- .2 Gyro-compass errors and corrections

Competence No.4: Coordinate search and rescue operations

4.1 **ABILITY TO APPLY THE PROCEDURES CONTAINED IN THE INTERNATIONAL AERONAUTICAL AND MARITIME SEARCH AND RESCUE (IAMSAR) MANUAL**

.1 The plan for coordinating search and rescue operations is in accordance with international guidelines and standards

.2 Radiocommunications are established and correct communication procedures are followed at all stages of the search and rescue operations

Competence No. 5: Establish watch-keeping arrangement and procedures

5.1 **THE INTERNATIONAL REGULATIONS FOR PREVENTING COLLISIONS AT SEA**

.1 COLREG' 72 and Amendments

5.2 **PRINCIPLES TO BE OBSERVED IN KEEPING A NAVIGATIONAL WATCH**

.1 Navigational watch

5.3 **EFFECTIVE BRIDGE TEAMWORK PROCEDURES**

.1 Bridge teamwork procedures

.2 Bridge team management

.3 Teamwork

Competence No. 6: Forecast weather

6.1 **SYNOPTIC CHARTS AND WEATHER FORECASTING**

.1 The planetary system of wind and pressure

.2 The weather associated with the principal air mass types

.3 Synoptic and prognostic charts and forecasts from any source

.4 The maritime forecast code and the range of information available through fax transmissions

6.2 **CHARACTERISTICS OF VARIOUS WEATHER SYSTEMS**

.1 The formation, structure and weather associated with the principal frontal systems

.2 The formation of, and weather associated with, frontal and non-frontal depressions

.3 The formation and weather characteristics of non frontal weather systems

.4 Tropical revolving storms (TRS)

6.3 **CALCULATION OF TIDAL CONDITIONS**

.1 Apply the relevant weather conditions to tidal calculations

6.4 **APPROPRIATE NAVIGATIONAL PUBLICATONS ON TIDES AND CURRENTS**

.1 Navigational publications on tides and currents

Competence No. 7: Respond to navigational emergencies

7.1 **PRECAUTIONS WHEN BEACHING A SHIP**

.1 Precautions when beaching a ship

7.2 **ACTION TO BE TAKEN IF GROUNDING IS IMMINENT AND AFTER GROUNDING**

.1 Action to be taken if grounding is imminent and after grounding

7.3 **REFLOATING A GROUNDED SHIP WITH AND WITHOUT ASSISTANCE**

.1 Refloating

7.4 **ACTION TO BE TAKEN IF COLLISION IS IMMINENT AND FOLLOWING A COLLISION OR IMPAIRMENT OF THE WATERTIGHT INTRGRITY OF THE HULL BY ANY MEANS**

.1 Collision

7.5 **ASSESSMENT OF DAMAGE CONTROL**

.1 Assessment of damage control

7.6 **EMERGENCY STEERING**

.1 Emergency steering

7.7 **EMERGENCY TOWING ARRANGEMENTS AND TOWING PROCEDURES**

.1 Emergency towing arrangements

Competence No. 8: Manoeuvre and handle a ship in all conditions

8.1 **MANOEUVRING AND HANDLING A SHIP IN ALL CONDITIONS**

.1 Approaching a pilot vessel
.2 Ship handling in restricted waters
.3 Constant rate of turn techniques
.4 Manoeuvring in shallow water
.5 Interaction: bank, canal, ship and tug
.6 Berthing and unberthing
.7 Use of propulsion and manoeuvring systems
.8 Anchoring
.9 Dry docking
.10 Handling ships in heavy weather
.11 Rescue boats and survival craft
.12 Manoeuvring and propulsion characteristics
.13 Damage due to own ship's bow and stern waves
.14 Manoeuvring in traffic separation schemes and VTS

Competence No. 9: Operate remote controls of propulsion plant and engineering systems and services

9.1 **OPERATING PRINCIPLES OF MARINE POWER PLANTS**

9.2 **SHIPS'AUXILIARY MACHINERY**

9.3 **GENERAL KNOWLEDGE OF MARINE ENGINEERING TERMS**

.1 Marine engineering terms and fuel consumption

FUNCTION: CARGO HANDLING AND STOWAGE AT THE MANAGEMENT LEVEL

Competence No. 1: Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes

1.1 **APPLICATION OF INTERNATIONAL REGULATIONS CODES AND STANDARDS CONCERNING THE SAFE HANDLING STOWAGE, SECURING AND TRANSPORT OF CARGOES**

.1 Plans and actions conform with international regulations

1.2 **EFFECT ON TRIM AND STABILITY OF CARGOES AND CARGO OPERATIONS**

.1 Draft, trim and stability

1.3 **STOWAGE AND SECURING OF CARGOES ON BOARD SHIP CARGO-HANDLING GEAR AND SECURING AND LASHING EQUIPMENT**

.1 Timber deck cargoes
.2 Procedures for receiving, tallying and delivering cargo
.3 Care of cargo during carriage
.4 Requirements applicable to cargo-handling gear
.5 Maintenance of cargo gear
.6 Maintenance of hatch covers

1.4 **LOADING AND UNLOADING OPERATIONS, WITH SPECIAL REGARD TO THE TRANSPORT OF CARGOES IDENTIFIED IN THE CODE OF SAFE PRACTICE FOR CARGO STOWAGE AND SECURING**

.1 Loading, stowage and discharge of heavy weights
.2 Care of cargo during carriage
.3 Methods and safeguards when fumigating holds

1.5 **GENERAL KNOWLEDGE OF TANKERS AND TANKER OPERATIONS**

.1 Terms and definitions
.2 Oil tanker operations and related pollution-prevention regulation
.3 Chemical tankers
.4 Tank cleaning & control of pollution in chemical tankers

Competence No. 2 Assess reported defects and damage to cargo Spaces, hatch covers and ballast tanks and take Appropriate action.

2.1 **LIMITATIONS ON STRENGTH OF SHIP**

.1 Vital constructional parts of standard bulk carrier

2.2 **AVOIDING DETRIMENTAL EFFECTS ON BULK CARRIERS**

.1 Corrosion
.2 Fatigue and inadequate cargo handling

Competence No. 3: Carriage of dangerous cargoes

3.1 **INTERNATIONAL REGULATIONS, STANDARDS, CODES AND RECOMMENDATIONS ON CARRIAGE OF DANGEROUS CARGOES**

.1 International regulations and codes

3.2 **EFFECT ON TRIM AND STABILITY OF CARGOES AND CARGO OPERATIONS**

.1 Dangerous goods in packages
.2 Solid bulk cargoes
.3 The IMO Grain Rules

FUNCTION: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

Competence No. 1: Control trim, stability and stress

1.1 **FUNDAMENTAL PRICIPLES OF SHIP CONSTRUCTION TRIM AND STABILITY**

.1 Shipbuilding materials
.2 Welding

.3 Bulkheads
.4 Watertight and watertight doors
.5 Corrosion and its prevention
.6 Surveys and dry-docking
.7 Stability

1.2 **EFFECT ON TRIM STABILITY IN THE EVENT OF DAMAGE AND FLOODING**

.1 Effect on trim and stability of a ship in the event of damage to and consequent flooding of a compartment and countermeasures to be taken
.2 Theories affecting trim and stability

1.3 **KNOWLEDGE OF IMO RECOMMENDATIONS CONCERNING SHIP STABILITY**

.1 Responsibilities under the relevant requirements of the International Conventions and Codes

Competence No. 2: Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment.

2.1 **INTERNATIONAL MARITIME LAW EMBODIED IN INTERNATIONAL CONVENTIONS**

.1 Certificates and other documents required to be carried on board ships by international conventions
.2 Responsibilities under the relevant requirements of the International Convention on Load Lines
.3 Responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea
.4 Responsibilities under the International Convention for the Prevention of Pollution from Ships
.5 Maritime declarations of health and the requirements of the International Health Regulations
.6 Responsibilities under international instruments affecting the safety of the ship, passengers, crew and cargo
.7 Methods and aids to prevent pollution of the marine environment by ships
.8 National legislation for implementing international agreements and conventions

Competence No. 3: Maintain safety and security of the ship's crew and passengers and the operational condition of life-saving, fire fighting and other safety systems

3.1 **KNOWLEDGE OF LIFE-SAVING APPLIANCE REGULATIONS**

3.2 **ACTIONS TO BE TAKEN TO PROTECT AND SAFEGUARD ALL PERSONS ON BOARD IN EMERGENCIES**

3.3 **ACTIONS TO LIMIT DAMANGE AND SALVE THE SHIP FOLLOWING A FIRE, EXPLOSION, COLLISION OR GROUNDING**

Competence No. 4: Develop emergency & damage control plans & handle emergency situations

4.1 **PREPARATION OF CONTINGENCY PLANS FOR RESPONSE TO EMERGENCIES**

4.2 **SHIP CONSTRUCTION INCLUDING DAMAGE CONTROL**

4.3 **METHODS AND AIDS FOR FIRE PREVENTION, DETECTION AND EXTINCTION**

4.4 **FUNCTIONS AND USE OF LIFE-SAVING APPLIANCES**

Competence No. 5: Leadership and Managerial Skills

5.1 **SHIPBOARD PERSONNEL MANAGEMENT AND TRAINING**

- .1 Shipboard Personnel management
- .2 Organization of staff
- .3 Training on board ships

5.2 **RELATED INTERNATIONAL MARITIME CONVENTIONS AND NATIONAL LEGISLATION**

- .1 Related international maritime conventions and recommendations, and national legislation

5.3 **TASK AND WORKLOAD MANAGEMANT**

- .1 Planning and co-ordination
- .2 Personal assignment
- .3 Time and resource constraints
- .4 Prioritization

5.4 **EFFECTIVE RESOURCE MANAGEMENT**

- .1 Allocation, assignment and prioritization of resources
- .2 Effective communication on board and ashore
- .3 Decisions reflect consideration of team experiences
- .4 Assertiveness and leadership, including motivation.
- .5 Obtaining and maintaining situational awareness

5.5 **DECISION- MAKING TECHNIQUES**

- .1 Situation and risk assessment
- .2 Identify and generate options
- .3 Selecting course of action
- .4 Evaluation of outcome effectiveness

5.6 **DEVELOPMENT, IMPLEMENTATION AND OVERSIGHT OF STANDARD OPERATING PROCEDURES**

Competence No.6: Organise and manage the provision of medical care on board

6.1 **KNOWLEDGE AND USE OF MEDICAL PUBLICATIONS**

- .1 International Medical Guide for ships
- .2 International Code of Signals (medical section)
- .3 Medical First Aid Guide for Use in Accidents Involving Dangerous Goods

SYLLABUSES FOR ORAL EXAMINATION
DECK OFFICER CLASS IV
CERTIFICATE OF COMPETENCY
(Under STCW Convention, Regulation II/2)

1. NAVIGATION

1.1 Plan and Conduct Safe Navigation

.1 demonstrate an ability to undertake voyage planning, taking into consideration:
  .1 restricted waters;
  .2 meteorological conditions, through the interpretation of a synoptic chart, and to forecast local area weather, the characteristics of various weather systems;
  .3 restricted visibility;
  .4 the requirements of ship routeing and mandatory reporting systems;
  .5 reporting in accordance with ship reporting systems;

.2 limitations of electronic chart systems including ECDIS and RCDS;

.3 port radio information services: knowledge of available services for vessels entering ports, berthing, as indicated in ALRS - VTS, Port Operations and Pilot Stations;

.4 maritime buoyage systems - IALA region 'A'.

1.2 Establish & Maintain Safe Watch-keeping Arrangements and Procedures

.1 a thorough knowledge of the principles of navigational watch-keeping at sea, including under pilotage, and watch-keeping at anchor and in port;

.2 a thorough knowledge of the content, application and intent of the COLREGS;

.3 knowledge of principles of establishing a safe engineering watch at sea, anchor and in port.

1.3 Compasses

.1 compasses commonly fitted on board the ships concerned - variation and deviation, causes and effects, sitting of other equipment with reference to magnetic compasses;

.2 knowledge of the purpose of correctors/corrections.

1.4 Manoeuvre the Ship and Operate Small Ship Power Plants

.1 anchoring and working anchors and cables in all circumstances;

.2 proper procedures for berthing and unberthing;

.3 knowledge of factors affecting safe manoeuvring and handling;

.4 knowledge of the operation of small ship power plants and auxiliaries.

2. CARGO HANDLING AND STOWAGE

2.1 Cargo Handling, Stowage, Securing and Care

.1 knowledge of the regulations and recommendations affecting cargo handling, stowage, securing and carriage;

.2 use of the IMDG Code

3. RESPONSE TO EMERGENCIES

3.1 Response to Navigational Emergencies

.1 action to be taken when disabled and in distress, abandoning ship, survival procedure, use of rockets and rocket apparatus;

.2 measures to be taken following collision, grounding, heavy weather damage and leaks including the possibility of beaching a ship;
.3 towing and being towed;
.4 knowledge of emergency steering systems;
.5 knowledge of search and rescue procedures, assisting a ship or aircraft in distress, rescuing the passengers and crew of a disabled ship or ditched aircraft;
.6 use of the International Aeronautical and Marine Search and Rescue (IAMSAR) Manual (Volume III), distress and emergency signals;
.7 Search and Rescue (SAR) plans for passenger ships;
.8 emergency communications within the GMDSS regulations.

3.2 **Response to Other Emergencies**

.1 methods of dealing with fire onboard ship; prevention of fire at sea and in port;
.2 use and maintenance of fire-fighting equipment, fire dampers, doors and screens, and detection equipment;
.3 the organisation and direction of fire-fighting drill training;
.4 launch and manage survival craft, recover rescue boats at sea;
.5 the organisation and direction of life-boat and life-raft drill training;
.6 understand the fundamental actions to be taken in the event of partial loss of intact buoyancy;
.7 precautions for the protection and safety of passengers in emergencies;
.8 appreciation of action to be taken when emergencies arise in port;
.9 sources of medical information available.

4. SHIPBOARD OPERATIONS

4.1 **Pollution Prevention Requirements**

.1 precautions to be taken to prevent pollution of the marine environment as required by the MARPOL Conventions, including Restricted Areas;
.2 take appropriate action in response to pollution incidents onboard and found at sea;
.3 knowledge of the contents of the SOPEP manual, Garbage Management Plans, and antipollution equipment;
.4 master's duties, obligations and liabilities, including the keeping of records.

4.2 **Seaworthiness of the Ship**

.1 precautions to be taken before the onset of heavy weather, management of small ships in heavy weather, handling a disabled ship;
.2 understand the fundamentals of water tight integrity;
.3 preparation for dry-docking and undocking, with and without cargo/damage – general procedure and precautions to be observed;
.4 working knowledge of stability and trim information.

4.3 **Legislative Requirements**

.1 contents and use of Merchant Shipping Notices, Marine Guidance Notes, Marine Information Notes and the Annual Summary of Admiralty Notices to Mariners;
.2 knowledge of the application of current Merchant Shipping Health and Safety legislation, including the Code of Safe Working Practices for Merchant Seamen, and the main elements of Risk Assessment;

.3 knowledge of the relevant IMO conventions concerning safety of life at sea and protection of the marine environment;
.4 crew agreements, the official log book and the law relating to entries, inspection of living quarters and storerooms, complaints procedure;
.5 reports required by the Marine Accident Investigation Branch (MAIB);
.6 Load line marks - entries and reports in respect of freeboard, draft and allowances;
.7 the requirements of the regulations concerning life-saving and fire-fighting appliances;
.8 application of hours of work and rest legislation;
.9 the law relating to the reporting of dangers to navigation;
.10 a knowledge of the master's obligations with respect to pilotage;
.11 purpose and application of the International Safety Management (ISM) Code and of the International Ship and Port Facility Security (ISPS) Code;
.12 purpose of Flag State and Port State Control.

SYLLABUSES FOR ORAL EXAMINATION
DECK OFFICER CLASS V
CERTIFICATE OF COMPETENCY
(Under STCW Convention, Regulation II/2)

1. ***NAVIGATION***

1.1 **Plan and Conduct a Passage Including Position Determination**

.1 passage planning with respect to the use of navigational publications including navigational charts, sailing directions, light lists, tide tables, radio navigational warnings and ships' routeing information;

.2 the requirements of ship routeing and mandatory reporting systems;

.3 buoyage systems - IALA region 'A';

.4 radar - practical use of, modes of operation, sources of error and parallel indexing;

.5 to use an azimuth mirror for taking bearings, including the determination of compass errors;

.6 operational limitations of the navigational equipment commonly fitted on board.

1.2 **Maintain a Safe Navigational Watch**

.1 a thorough knowledge of the principles of navigational watch-keeping at sea, including under pilotage, and watch-keeping at anchor and in port;

.2 a thorough knowledge of the content, application and intent of the COLREGS;

.3 knowledge of steering control systems, including autopilot, change-over procedures from manual to automatic & vice-versa and, adjustment of controls for optimum performance;

.4 radar - practical use of, modes of operation, sources of error, plotting and parallel indexing;

.5 meteorology: ability to use and interpret information obtained from ship borne meteorological instruments, knowledge of the characteristics of the various weather systems, reporting procedures and recording systems, ability to apply the meteorological information available.

.6 the use of all bridge equipment commonly fitted on board the ships concerned.

1.3 **Compasses**

.1 use and limitations of compasses commonly fitted on board the ship concerned.

1.4 **Manoeuvre the Ship**

.1 preparation for getting under way, duties prior to proceeding to sea, making harbour, entering a dock, berthing alongside quays, jetties, or other ships, and securing to buoys;

.2 helm orders, conning the ship, effects of propellers on the steering of a ship, effects of wind and current, stopping, going astern, turning short round, interaction and squat;

.3 action in event of failure of: - bridge control, telegraph or steering; emergency steering arrangements;

.4 onboard procedures for anchoring.

2. *CARGO HANDLING AND STOWAGE*

2.1 Loading and Unloading of Cargoes

.1 use and care of synthetic fibre and wire ropes, ascertaining of safe-working loads;

.2 basic knowledge of regulations and recommendations affecting cargo handling, stowage, securing and carriage, including the IMDG Code;

.3 use of the hydrometer.

3. RESPONSE TO EMERGENCIES

3.1 Response to Navigational Emergencies

.1 initial action following: man overboard, collision, grounding, flooding or major mechanical damage and receipt of a distress message; initial damage assessment and control, protection of the marine environment;

.2 precautions for the protection and safety of passengers in emergency situations;

.3 use of the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual (Volume III), distress and emergency signals;

.4 use of International Code of Signals;

.5 emergency communications within the GMDSS regulations.

3.2 Response to Other Emergencies

.1 emergency organizational procedures commonly found on board the ships concerned;

.2 knowledge of fire prevention;

.3 knowledge of classes and chemistry of fire;

.4 knowledge of fire-fighting systems commonly found on board the ships concerned;

.5 understanding of action to be taken in the event of fire, including fires involving oil;

.6 use and care of life-saving appliances and equipment including portable radios, EPIRBs, SARTs, immersion suits and thermal protective aids, and rocket line throwing apparatus;

.7 correct use of distress signals and awareness of penalties for misuse;

.8 operation of survival craft and rescue boats;

.9 Knowledge of survival at sea techniques;

.10 knowledge of contents of LSA training manuals;

.11 ability to organize abandon ship drills;

.12 sources of medical information available.

4. SHIPBOARD OPERATIONS

4.1 Pollution Prevention Requirements

.1 precautions to be taken to prevent pollution of the marine environment as required by the MARPOL Conventions, including Restricted Areas;

.2 basic understanding of the SOPEP manual and Garbage Management Plans.

4.2 Seaworthiness of the Ship

.1 understand fundamentals of water tight integrity, and the closing of all openings including hatch covers, access hatches and watertight doors;

.2 preparations for heavy-weather;

.3 working knowledge of the use of stability and trim information on board small vessels.

4.3 **Legislative Requirements**

.1 contents and use of Merchant Shipping Notices, Marine Guidance Notes, Marine Information Notes and the Annual Summary of Admiralty Notices to Mariners;

.2 knowledge and application of current Merchant Shipping Health and Safety legislation and the Code of Safe Working Practices for Merchant Seamen;

.3 purpose of the International Safety Management (ISM) Code;

.4 purpose of Flag State and Port State Control.

ANNEX (D)

SYLLABUS FOR WRITTEN EXAMINATION OF MARINE ENGINEER OFFICER CLASS I CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/2)

FUNCTION 1: MARINE ENGINEERING AT THE MANAGEMENT LEVEL

1.1 **MANAGE THE OPERATION OF PROPULSION PLANT MACHINERY**

- .1 Designated feature of
  - .1 Marine Turbine.
- .2 Designated feature of
  - .1 Gas Turbine.
- .3 Manage the operation of steam plant
  - .1 Marine Steam Boiler and associated auxiliaries
    - .1 Marine steam boilers.
    - .2 Feed water systems.

1.2 **PLAN AND SCHEDULE OPERATIONS *(Theoretical knowledge)***

- .1 Refrigerators and refrigeration cycle.
- .2 Physical and chemical properties of fuels and lubricants.

1.3 **OPERATION, SURVEILLANCE, PERFORMANCE ASSESSMENT AND MAINTAINING SAFETY OF PROPULSION PLANT AND AUXILIARY MACHINERY *(Practical knowledge)***

- .1 Start up and shut down main and auxiliary machinery, including associated system
  - .1 Engine Lubrication
    - .1 Diesel engine lubricant types, properties, and applications.
    - .2 Principles of diesel engine lubrication.
    - .3 Contamination and deterioration of diesel engine lubricants.
    - .4 The distribution of lubricating oil to diesel engines.
  - .2 Fuel Injection
    - .1 atomization and penetration
    - .2 Injection pressures and viscosities
    - .3 For varying fuel types.
    - .4 Constant and variable injection timing.
    - .5 Injection requirements.
    - .6 Faults, symptoms, and causes of combustion problems,
    - .7 Occupational Health & Safety.
    - .8 Normal operating Parameters.
    - .9 Methods which reduce this pollution (especially SOx and NOx reduction).
  - .3 Scavenging and Supercharging
  - .4 Starting and Reversing
  - .5 Diesel Engine
  - .6 Diesel Engine Emergency operation
  - .7 Hydraulic power system
  - .8 Types of auxiliary Boilers.
  - .9 Boiler water levels.

.10 Boiler Water Treatment.
.11 Boiler defects .
.12 Boiler and Steam. turbine survey and repairs.
.13 Evaporators
.14 Boiler and Steam. turbine survey and repairs.
.15 Evaporators

.2 The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery
.1 Diesel engines

.3 Function and mechanism of automatic control for auxiliary machinery:
.1 Generator distribution system.

FUNCTION 2: ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT THE MANAGEMENT LEVEL

2.1 MANAGE OPERATION OF ELECTRICAL AND ELECTRONICS CONTROL *(Theoretical knowledge)*

.1 Marine electro technology, electronics, power electronics, automatic control engineering and safety devices
.1 Electronics, Power Electronics
.1 Semiconductor devices
.2 Integrated Circuits
.3 Eelectronic fault diagnosis
.2 Automatic Control Engineering and safety devices.
.1 Basic concepts
.2 Sensors and transmitters
.3 Basic Control
.4 Final Control Elements
. 5 Control Loop Analysis
.6 operation and use of governors

.2 Design features and system configuration of automatic control equipment and safety devices
.1 Main Engine
.1 Control Theory
.2 Tuning
.3 Signal Transmission Systems
.4 Final Control Elements
.5 Electronic PID Controllers
.6 Monitoring & Control Systems
.7 General requirements of automatic control equipment and safety devices
.8 Remote control - Diesel propulsion
.9 MS Systems

.3 Design features and system configuration of operational control equipment for electrical motors.
.1 Three Phase A.C. Motors
.2 Three Phase Synchronous Motors
.3 Effect of varying frequency and voltage of A.C. Motors
.4 Insulated Gate Bipolar Transistor (IGBT) motor speed control .
.5 Motor speed control by Thyristors
.6 Three Phase Generators

.7 Three Phase Transformers
.8 Distribution
.9 Emergency Power

.4 Design features of high-voltage installations (Exclusive course)
.1 Design features of high-voltage installations

.5 Features of pneumatic and hydraulic control equipment
.1 Hydraulic Control Equipments
.2 Pneumatic Control Equipment

2.2 **MANAGE TROUBLE SHOOTING RESTORATION OF ELECTRICAL AND ELECTRONIC CONTROL EQUIPMENT TO OPERATING CONDITION (*Practical knowledge)***

.1 Trouble shooting of electrical and electronic control equipment
.1 Electrical Safety
.2 Test Equipment
.3 Interpretation of Circuit Symbols
.4 Logical six step troubleshooting procedure
.5 Generation
.6 Prime Mover Electrical Controls
.7 Main Air Circuit Breaker
.8 Protection of Generators
.9 Electrical Distribution Systems
.10 Motors
.11 Electrical Survey Requirements
.12 Calibrate & Adjust Transmitters & Controllers
.13 Control System Fault Finding

.2 Function test of electrical, electronic control equipment and safety devices
.1 Function test of electrical, electronic control equipment and safety devices

.3 Trouble shooting of monitoring systems
.1 Test and calibrations of sensors and transducers of monitoring system

.4 Software version control
.1 Programmable logic controllers (PLC).
.2 Microcontrollers
.3 Digital Techniques

FUNCTION 3: MAINTENANCE AND REPAIR AT THE MANAGEMENT LEVEL

3.1 **MANAGE SAFE AND EFFICIENT MAINTENANCE AND REPAIR PROCEDURES**

.1 Marine engineering practice *Theoretical knowledge*
.1 Classification society and class certificates
.2 preparation and use of planned maintenance systems (PMS) as per ISM code.

.2 Manage safe and effective maintenance and repair procedure ***(Practical knowledge)***
.1 Manage safe and effective maintenance and repair procedures relevant to3.1.1 3.1.3 Manage safe and effective maintenance and repair procedure ***(Practical knowledge)***

.3 Manage safe and effective maintenance and repair procedure
.1 Planning maintenance
.2 Dismantling and inspection/ calibrations
.3 Statutory and class verification

.4 Planning repairs ***(Practical knowledge)***
.1 Planning repairs relevant to 3.1.1

3.2 **DETECT AND IDENTIFY THE CAUSE OF MACHINERY MALFUNCTIONS AND CORRECT FAULTS (*Practical knowledge)***

.1 Detection of machinery malfunction, location of faults and action to prevent damage
  .1 Unplanned maintenance

.2 Inspection and adjustment of equipment
  .1 Inspection and adjustment of equipment relevant to 3.1.1

.3 Non-destructive examination
  .1 Different types of non-destructive examination

3.3 **ENSURE SAFE WORKING PRACTICES (*Practical knowledge)***

.1 Safe Working

FUNCTION 4: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD

4.1 **CONTROL TRIM, STABILITY AND STRESS**

.1 Fundamental principles of ship construction and the theories affecting trim and stability and measures necessary to preserve trim and stability.
  .1 Ship Types and Terms
  .2 Stresses in Ship Structures
  .3 Ship Construction
  .4 Ship Dynamics
  .5 Hydrostatics
  .6 Displacement, TPC, Coefficients of Form
  .7 Areas and Volumes of Ship Shapes, first and Second Moments
  .8 Centres of Gravity
  .9 Transverse Stability
  .10 Trim
  .11 Stability during Dry docking and stability during grounding
  .12 Resistance and Fuel Consumption
  .13 Propellers and Power
  .14 Rudders

.2 Effect on trim and stability in event of damage to and consequent flooding of compartment and counter measures to be taken
  .1 Effect of flooding on transverse stability and trim

.3 IMO recommendations concerning ship stability
  .1 IMO recommendations concerning ship stability

4.2 **MONITOR AND CONTROL COMPLIANCE WITH LEGISLATIVE REQUIREMENTS AND MEASURES TO ENSURE SAFETY OF LIFE AT SEA AND PROTECTION OF THE MARINE ENVIRONMENT**

.1 Knowledge of relevant international maritime law embodied in international agreements and convention
  .1 United Nations Convention on the Law of Sea 1982(UNCLOS)
  .2 Treaties, conventions, protocols, rules and regulations
  .3 International Maritime Organization (IMO)
  .4 List of IMO Conventions
  .5 Introduction to International Labour Organization (ILO)
  .6 World Health Organization (WHO)
  .7 Authorities and Regulations

.2 Certificates and other documents to be carried on board ships by international conventions, how they may be obtained and period of their legal validity

.1 List of Certificates and documents to be carried on board ships as per SOLAS Annex 1, how they are obtained and their period of validity

.2 Additional certificates and documents required on board ship

.3 Responsibilities under the relevant requirements of the international convention on load lines

.1 International Convention on Load Lines

.4 Responsibilities under the relevant requirements of the international convention for the safety of life at sea

.1 International Convention for the Safety of Life at Sea–Brief description of following chapters

.2 Obligation to carry out periodical surveys and maintain validity of following certificates.

- Obligation to maintain following Records
- Obligation and rights of master

.5 Responsibilities under the relevant requirements of the international convention for the prevention of pollution from ships.

.1 Annex I – Oil

.2 Annex II– Noxious Liquid Substances in Bulk

.3 Annex III – Harmful substances carried in packaged form

.4 Annex IV – Sewage

.5 Annex V – Garbage

.6 Annex VI – Air Pollution

.6 Maritime declarations of health and the requirements of the international health regulations.

.1 WHO's International Health Regulations 2005 (IHR)

.2 International Medical Guide for Ship (IMGS) and recommendations for the ship's medicine chest and equipment

.3 International Maritime Organization's Medical First Aid Guide for Use in Accidents involving Dangerous Goods (MFAG)

.4 WHO's Guidelines for Drinking-water quality.

.7 Responsibilities under international instruments affecting the safety of the ship, passengers, crew or cargo

.1 ILO's Maritime Labour Convention 2006 (MLC 2006)

.2 International Convention on Salvage,1989 – Lloyd's Standard Form of Salvage Agreement (LOF, 2000).

3 Convention on Limitation of Liability of Maritime Claims, 1976 (LLMC 1976)

.4 Charter parties

.5 Marine Insurance, General Average and P & I Club

.8 Methods and aids to prevent pollution of the environment by ships

.1 Sources of Marine pollution

.2 Effects of marine oil spills

.3 Regulations for prevention of oil pollution as per Annex I of MARPOL 73/78

.4 Regulations for control of pollution from Noxious liquid substances carried in bulk as per Annex II of MARPOL 73/78

.5 Regulations for the Prevention of Pollution by Harmful substances carried by sea in packaged form as per Annex III of MARPOL 73/78

.6 Requirements covering the carriage of dangerous goods by sea as per Chapter VII of the SOLAS Convention

.7 Regulations for the Prevention of Pollution by Sewage from Ships as per Annex IV of MARPOL 73/78

.8 Regulations for the Prevention of Pollution by Garbage from Ships as per Annex V of MARPOL 73/78

.9 Regulations for the Prevention of Air Pollution as per Annex VI of MARPOL 73/78

.10 International Convention for the Control and Management of Ship's Ballast Water and Sediment

.11 Anti-fouling paints

.12 Noise

4.3 **MAINTAIN SAFETY AND SECURITY OF THE VESSEL, CREW AND PASSENGERS AND THE OPERATIONAL CONDITION OF THE LIFE SAVING, FIRE FIGHTING AND OTHER SAFETY SYSTEM.**

.1 Life saving appliances regulations.

.2 Organization of fire and abandon ship drills.

.3 Maintenance of Life-saving, Fire-fighting and Other Safety Systems.

.4 Actions to be taken to protect and safeguard all persons on board in emergencies.

.5 Action to limit damage and salve the ship following fire explosion, collision of grounding.

4.4 **DEVELOP EMERGENCY AND DAMAGE CONTROL PLANS AND HANDLE EMERGENCY SITUATION**

.1 Method and aids for fire prevention, detection and extinction.

.2 Function and use of life saving appliances.

.1 Life saving appliances

4.5 **USE LEADERSHIP AND MANAGERIAL SKILLS (EXCLUSIVE COURSE)**

.1 Knowledge and ability to apply decision-making technique

.2 Development, Implementation, and oversight of standard operating procedures

SYLLABUS FOR ORAL EXAMINATION OF
MARINE ENGINEER OFFICER CLASS I
CERTIFICATE OF COMPETENCY
(Under STCW Convention, Regulation III/2)

The syllabus for the Oral Examination shall cover the following functions;

Function 1. Marine engineering at the management level
Function 2. Electrical, electronic and control engineering at the management level
Function 3. Maintenance and repair at the management level
Function 4. Controlling the operation of ship and care for persons on board at the management level.

General outlines for Oral Syllabus

- Operation, maintenance and management of the ship's structure and machinery
- Management and organisation of the engine room department
- Safety and protection of personnel, machinery and environment
- Pumps and pumping systems
- Emergency procedures and the safe control and operation of machinery and equipment
- Suitable temporary and permanent repair procedures
- Machinery design, construction and installation
- Fire prevention, detection and extinction
- Factors affecting the stability of the ship
- Electrical systems
- Control systems
- Interpretation of machinery data and measurements
- Maritime law and conventions
- Training of engine room staff
- ISM Code and occupational health & safety

Note: The above is a guideline only and the content of the individual oral examinations may vary. The examiner may not cover all areas noted.

SYLLABUS FOR ORAL EXAMINATION OF MARINE ENGINEER OFFICER CLASS I CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/2)

1. Boilers

.1 Water gauge
  .1 Local
  .2 Remote
.2 Manhole doors
.3 Feed check V/Vs
.4 Blow down V/Vs
.5 Safety valves
.6 Operations
.7 Furnace purging
.8 Uptake fires
.9 Super heater fires
.10 Raising steam
.11 Shutting down, lay up
.12 Water testing
.13 Water hammer
.14 Priming and foaming
.15 Construction arrangement
.16 Automatic controls
.17 Survey
.18 Combustion
.19 Associated systems & equipment

2. Diesel Propulsion

.1 Operation
.2 Crankcase explosion
.3 Scavenge fires
.4 Air line explosion
.5 Manoeuvring
.6 Emergency
.7 Warming through
.8 Shutting down
.9 Parameters
.10 Fuel consumption
.11 Combustion
.12 Associated systems & equipment
.13 Slow, medium and high speed
.14 Manoeuvring controls

.15 Protection devices
.16 Construction
.17 Timing
.18 Lubrication
.19 Alignment
.20 Automation
.21 Clutches
.22 Gear boxes
.23 Vibration dampers
.24 Thrust bearing
.25 Turbochargers
.26 Diesel electric
.27 Survey
.28 Diesel alternators
.29 Water treatment

3. Steam Propulsion

.1 Operation
.2 Warming through
.3 Shutting down
.4 Manoeuvring
.5 Emergency
.6 Parameters
.7 Turbines
.8 Protection devices
.9 Thrust bearing
.10 Gland steam
.11 Flexible coupling
.12 Manoeuvring V/V
.13 Automation
.14 Protection devices
.15 Lubrication
.16 Impulse, reaction
.17 Gear boxes
.18 Alignment
.19 Survey
.20 Turbo electric
.21 Turbo alternators
.22 Operation and construction
.23 Associated Systems & Equipment

4. Water Treatment

.1 Evaporators
.2 Distillers
.3 Ion exchange
.4 Reverse osmosis

.5 Testing
.6 Chemicals

5. Feed Systems

.1 Arrangement
.2 Feed pumps
.3 De-aerators and heaters
.4 Air ejector
.5 Extraction pumps
.6 Condenser
.7 Water testing
.8 Automatic controls
.9 Corrosion

6. Steering Gear & Rudders

.1 Emergency operation
.2 Construction
.3 Control
.4 Lubrication
.5 Survey

7. Air Compressors

.1 Safety devices
.2 Compressor
.3 Receiver
.4 Air line
.5 Operation
.6 Lubrication
.7 Starting air
.8 Service and control air
.9 Receivers
.10 Automation
.11 Survey

8. Fire

.1 Prevention
.2 Extinction
.3 Hoses, extinguishers
.4 BA sets
.5 Procedures
.6 Fixed installations
.7 Detection
.8 Sensors, systems
.9 UMS requirements
.10 Structural fire protection

9. Pumping Systems

.1 Fire main
.2 Oily water separator
.3 Bunkering
.4 Bilge and ballast systems
.5 Salt water system
.6 Fresh water cooling
.7 Sewage plant
.8 Fuel oil system
.9 Diesel oil system
.10 Inert gas system
.11 Lubricating oil system
.12 Cargo system
.13 Sanitary system
.14 Purifiers, clarifiers
.15 Heaters
.16 Pumps: positive displacement, etc

10. Refrigeration Systems

.1 Safety
.2 Direct and indirect expansion
.3 Air conditioning
.4 Compressors

11. Materials

.1 Properties
.2 Destructive & non-destructive testing

12. Propellers & Thrusters

.1 Fixed pitch
.2 Attachment
.3 Survey
.4 Controllable pitch
.5 Operating system
.6 Attachment
.7 Survey
.8 Stern tube bearing
.9 Screw shafts
.10 Cross thrusters
.11 Fixed and controllable pitch propeller
.12 Voith schneider, etc
.13 DP systems

13. Dry Docking

.1 Supply of fire fighting water
.2 Supply of electrical power
.4 Stability
.5 Measurement of weardown, clearances

.6 Measurement of alignment
.7 Certificates of survey
.8 Annual
.9 Safety equipment
.10 Safety construction
.11 Load line
.12 Classification
.13 Ships structure
.14 Corrosion, erosion
.15 Cavitation
.16 Mechanical damage
.17 Cleaning, protection

14. Tanks

.1 Safety precautions
.2 Entering
.3 Pressure testing
.5 Survey

15. Stability

.1 Free surface
.2 Damage control

16. Electricity

.1 Emergency generators
.2 Operation
.3 Construction
.4 Statutory requirements
.5 Testing
.6 Fault detection
.7 AC generators
.8 Operation
.9 Construction
.10 Control equipment
.11 Fault detection
.12 Protection devices
.13 DC generators
.14 AC generator
.15 Distribution
.16 Isolation
.17 Electric shock
.18 Protection devices
.19 Fault detection
.20 Main switchboard
.21 Emergency switchboard
.22 Distribution boards
.23 Flame proof

.24 Drip proof
.25 Intrinsically safe
.26 Transformers
.27 Two wire
.28 Non-earthed and earthed neutral
.29 Motors
.30 AC: single and three phase

17. Deck Machinery

.1 Davits
.2 Winches
.3 Windlass
.4 Cranes
.5 Derricks
.6 Hatches
.7 Other

18. Automation & Control

.1 Bridge control
.2 UMS
.3 Fault detection
.4 Requirement
.5 Transfer from manual to auto
.6 Measuring devices
.7 Testing
.8 Calibration
.9 Survey

19. Machinery Records

.1 Oil record book
.2 Log books
.3 Trend recording
.4 Official records
.5 Combustion analysis
.6 Condition monitoring

20. Maritime Law

.1 MARPOL, SOLAS
.2 ISM code
.3 Marine orders
.4 Other

21. Management

.1 Training of engine-room staff
.2 Management and organisation of ER staff/dept

ANNEX (E)

SYLLABUS FOR WRITTEN EXAMINATION OF MARINE ENGINEER OFFICER CLASS II CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/2)

FUNCTION 1: MARINE ENGINEERING AT THE MANAGEMENT LEVEL

SUBJECT: MARINE ENGINEERING KNOWLEDGE (GENERAL AND MOTOR)

1.1 **MANAGE THE OPERATION OF PROPULSION PLANT MACHINERY**

.1 Design features and operative mechanism of the marine diesel engine and associated auxiliaries

.1 Design features and operative mechanism of Marine Diesel Engines and associated auxiliaries

.2 Design features and operative mechanism of a Marine Steam Turbines and associated auxiliaries

.1 Design features and operative mechanism of a Marine Steam Turbinesand associated auxiliaries

.3 Design features and operative mechanism of marine gas turbine and associated auxiliaries

.1 Design features and operative mechanism of marine gas turbine and associated auxiliaries

.4 Design features and operative mechanism of Marine Steam Boiler and associated auxiliaries

.1 Design features and operative mechanism of Marine Steam Boiler and associated auxiliaries

.5 Design features, and operative mechanism of propeller shaft and associated ancillaries

.1 Material selection and design features of propeller shaft and associated ancillaries:

.6 Technical Communications for design

.1 Technical Communications for design

.7 Manage the operation of steam propulsion plant machinery

.1 Design features and operative mechanism of a Marine Steam Turbines and associated auxiliaries

.2 Design features and operative mechanism of Marine Steam Boiler and associated auxiliaries

.3 Propulsive characteristics of Steam Turbine

.4 The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery

1.2 **PLAN AND SCHEDULE OPERATIONS (*theoretical knowledge)***

.1 Thermodynamics and heat transmission

.1 Thermodynamic Fundamentals

.2 Perfect Gas
.3 Second Law
.4 Gas Cycles/Engine Analysis
.5 Properties of Vapours
.6 Steam Cycles
.7 Steam Turbine Velocity Diagrams
.8 Refrigeration
.9 Combustion
.10 Compressors
.11 Heat Transfer
.12 Air Conditioning

.2 Mechanics and hydromechanics
.1 Statics
.2 Dynamics
.3 Friction
.4 Balancing
.5 Simple Harmonic Motion
.6 Stress & Strain
.7 Bending of Beam
.8 Torsion
.9 Struts
.10 Combined Stress
.11 Stresses In Thick Shells
.12 Fluid Mechanics

.3 Propulsive characteristics of diesel engines including speed, output and fuel consumption
.1 Engine layout and load diagrams

.4 Heat cycle, thermal efficiency and heat balance of the following
.1 Marine diesel engine
.2 Marine steam boiler and steam turbine
.3 Marine gas turbine

.5 Refrigerators and refrigeration cycle
.1 Refrigeration and Air Conditioning system

.6 Physical and chemical properties of fuels and lubricants
.1 Production of Oils from Crude Oil
.2 Properties and characteristics of fuels and lubricants
.3 Shore side and shipboard sampling and testing
.4 Interpretation of test results
.5 Contaminants including microbiological infection
.6 Treatment of fuels and lubricants including storage, centrifuging, blending, pretreatment and handling.

.7 Technology of material
.1 Metallurgy of Steel and Cast Iron
.2 Properties and application of material used in machinery on board ships
.3 Destructive and non-destructive testing of material
.4 Engineering processes used in construction and repair
.5 Materials and Welding

1.3 **OPERATION, SURVEILLANCE, PERFORMANCE ASSESSMENT AND MAINTAINING SAFETY OF PROPULSION PLANT AND AUXILIARY MACHINERY(*practical knowledge)***

.1 Start up and shut down main and auxiliary machinery, including associated system
- .1 Engine components
- .2 Engine Lubrication
- .3 Fuel Injection
- .4 Scavenging and Supercharging
- .5 Starting and Reversing
- .6 Cooling systems
- .7 Diesel Engine Control and Safety
- .8 Diesel Engine Emergency operation
- .9 Multi-engine Propulsion Arrangement
- .10 Air compressors and compressed air systems
- .11 Hydraulic power system
- .12 Types of auxiliary boilers
- .13 Auxiliary steam system
- .14 Safety valves
- .15 Boiler water levels
- .16 Use of 'Sea water in Boilers'
- .17 Use of 'Fresh Water in Boilers'
- .18 Boiler Water Testing
- .19 Boiler Water Treatment
- .20 Auxiliary Steam turbines
- .21 Boiler defects
- .22 Boiler and Steam turbine survey and repairs
- .23 Evaporators
- .24 Thermal fluid heating system

.2 Operation limits of propulsion plants

.3 The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery
- .1 Diesel engines

.4 Functions and mechanism of automatic control for main engine

.5 Function and mechanism of automatic control for auxiliary machinery:
- .1 Generator distribution system
- .2 Steam boiler
- .3 Oil purifier
- .4 Refrigeration and air conditioning system
- .5 Pumping and piping system
- .6 Steering gear system
- .7 Cargo-handling equipment and deck machinery

1.4 **MANAGE FUEL LUBRICATION AND BALLAST OPERATIONS**

.1 Operation and maintenance of machinery, including pumps and pumping system
- .1 Ballast
- .2 Bilge
- .3 Fire Main
- .4 Prevention of Pollution of the Sea by Oil
- .5 Sewage and sludge

FUNCTION 2: ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT THE MANAGEMENT LEVEL

SUBJECTS: ELECTRO TECHNOLOGY

2.1 **MANAGE OPERATION OF ELECTRICAL AND ELECTRONICS CONTROL (*theoretical knowledge)***

.1 Marne electro technology, electronics, power electronics, automatic control engineering and safety devices
- .1 Marine Electro-technology
- .2 Electronics, Power Electronics
- .3 Automatic Control Engineering and safety devices.

.2 Design features and system configuration of automatic control equipment and safety devices
- .1 General Requirements
- .2 Main Engine
- .3 Generator and distribution system
- .4 Steam boiler

.3 Design features and system configuration of operational control equipment for electrical motors, and design features of high-voltage installations
- .1 Three Phase A.C. Motors
- .2 Three Phase Synchronous Motors
- .3 Effect of varying frequency and voltage of A.C. Motors
- .4 Motor control and protection
- .5 Insulated Gate Bipolar Transistor (IGBT) motor speed control
- .6 Motor speed control by Thyristors
- .7 Three Phase Generators
- .8 Three Phase Transformers
- .9 Distribution
- .10 Emergency Power

.4 Design features of high-voltage installations (Exclusive course)
- .1 Design features of high-voltage installations

.5 Features of pneumatic and hydraulic control equipment
- .1 Hydraulic Control Equipments
- .2 Pneumatic Control Equipment

2.2 **MANAGE TROUBLE SHOOTING RESTORATION OF ELECTRICAL AND ELECTRONIC CONTROL EQUIPMENT TO OPERATING CONDITION (*Practical knowledge)***

.1 Trouble shooting of electrical and electronic control equipment
- .1 Electrical Safety
- .2 Test Equipment
- .3 Interpretation of Circuit Symbols
- .4 Logical six step troubleshooting procedure
- .5 Generation
- .6 Prime Mover Electrical Controls
- .7 Main Air Circuit Breaker
- .8 Protection of Generators
- .9 Electrical Distribution Systems
- .10 Motors
- .11 Electrical Survey Requirements
- .12 Calibrate & Adjust Transmitters & Controllers
- .13 Control System Fault Finding

.2 Function test of electrical, electronic control equipment and safety devices
.1 Function test of electrical, electronic control equipment and safety devices
.3 Trouble shooting of monitoring systems
.1 Test and calibrations of sensors and transducers of monitoring system
.4 Software version control
.1 Programmable logic controllers (PLC)
.2 Microcontrollers
.3 Digital Techniques

FUNCTION 3: MAINTENANCE AND REPAIR AT THE MANAGEMENT LEVEL
SUBJECTS: MARINE ENGINEERING KNOWLEDGE (GENERAL AND MOTOR)

3.1 **MANAGE SAFE AND EFFICIENT MAINTENANCE AND REPAIR PROCEDURES**
.1 Marine engineering practice Theoretical knowledge
.1 Classification society and class certificates
.2 Statutory certification of ships
.3 Surveys for maintenance and renewal of class and statutory certificates
.4 Discusses the preparation and use of planned maintenance systems (PMS) as per ISM code.
.2 Manage safe and effective maintenance and repair procedure *Practical knowledge*
.1 Manage safe and effective maintenance and repair procedures relevant to 3.1.1
.3 Manage safe and effective maintenance and repair procedure *Practical knowledge*
.1 Planning maintenance, including statutory and class verifications relevant to 3.1.1
.4 Planning repairs *Practical knowledge*
.1 Planning repairs relevant to 3.1.1

3.2 **DETECT AND IDENTIFY THE CAUSE OF MACHINERY MALFUNCTIONS AND CORRECT FAULTS**
.1 Detection of machinery malfunction, location of faults and action to prevent damage
.1 Unplanned maintenance
.2 Inspection and adjustment of equipment
.1 Inspection and adjustment of equipment relevant to 3.1.1
.3 Non-destructive examination
.1 Different types of non-destructive examination

3.3 **ENSURE SAFE WORKING PRACTICES**
.1 Safe Working
.1 Explains risk assessment practices and their use on board ship
.2 Discusses the role of safety officials on board ship
.3 Discusses the use of personal protective equipment
.4 Explains the requirements to ensure that work equipment is safe
.5 Discusses the use of safety induction procedures
.6 Explains the precautions required to minimize the risk of fire.
.7 Explains typical shipboard emergency procedures
.8 Discusses the requirements to ensure the safe movement of personnel
.9 Discusses safe work practices when
.10 Identifies the risks and the safety precautions and procedures for entering enclosed or confined spaces.

.11 Discusses the use of permit to work systems
.12 Identifies safe practices for manual handling
.13 Discusses the safe use of common shipboard equipment
.14 Explain procedures for the safe use of lifting plant
.15 Discusses procedures for the maintenance of machinery
.16 Discusses procedures for undertaking hot work on board ship
.17 Explains the preparation and use of paint systems on board ship
.18 Discusses procedures for working safely with hazardous substances
.19 Discusses procedures for minimizing adverse effects of noise and vibrations

FUNCTION 4: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

SUBJECTS: 1. NAVAL ARCHITECTURE AND SHIP CONSTRUCTION
2. GENERAL ENGINEERING KNOWLEDGE

4.1 **CONTROL TRIM, STABILITY AND STRESS**

.1 Manage safe and effective maintenance and repair procedures
.1 Fundamental principles of ship construction and the theories affecting trim and stability and measures necessary to preserve trim and stability
.1 Ship Types and Terms
.2 Stresses in Ship Structures
.3 Ship Construction
.4 Ship Dynamics
.5 Hydrostatics
.6 Displacement, TPC, Coefficients of Form
.7 Areas and Volumes of Ship Shapes, First and Second Moments
.8 Centres of Gravity
.9 Transverse Stability
.10 Trim
.11 Stability during Drydocking and stability during grounding
.12 Resistance and Fuel Consumption
.13 Propellers and Power
.14 Rudders
.2 Effect on trim and stability in event of damage to and consequent flooding of compartment and counter measures to be taken
.1 Effect of flooding on transverse stability and trim
.2 Countermeasures to be taken
.3 IMO recommendations concerning ship stability
.1 IMO recommendations concerning ship stability

4.2 **MONITOR AND CONTROL COMPLIANCE WITH LEGISLATIVE REQUIREMENTS AND MEASURES TO ENSURE SAFETY OF LIFE AT SEA AND PROTECTION OF THE MARINE ENVIRONMENT**

.1 Knowledge of relevant international maritime law embodied in international agreements and convention
.1 United Nations Convention on the Law of Sea 1982 (UNCLOS)
.2 Treaties, conventions, protocols, rules and regulations
.3 International Maritime Organization (IMO)
.4 List of IMO Conventions
.5 Introduction to International Labour Organization (ILO)
.6 World Health Organization (WHO)
.7 Authorities and Regulations

.2 Certificates and other documents to be carried on board ships by international conventions, how they may be obtained and period of their legal valididity
  .1 List of Certificates and documents to be carried on board ships as per SOLAS Annex 1, how they are obtained and their period of validity
  .2 Additional certificates and documents required on board ship
.3 Responsibilities under the relevant requirements of the international convention on load lines
  .1 International Convention on Load Lines
.4 Responsibilities under the relevant requirements of the international convention for the safety of life at sea
  .1 International Convention for the Safety of Life at Sea – Brief description of following chapters:
  .2 Obligation to carry out periodical surveys and maintain validity of following certificates:
  .3 Obligation to maintain following records
  .4 Obligation and rights of master
.5 Responsibilities under the relevant requirements of the international convention for the prevention of pollution from ships
  .1 Annex I – Oil
  .2 Annex II – Noxious Liquid Substances in Bulk
  .3 Annex III – Harmful substances carried in packaged form
  .4 Annex IV – Sewage
  .5 Annex V – Garbage
  .6 Annex VI – Air Pollution
.6 Maritime declarations of health and the requirements of the international health regulations
  .1 WHO's International Health Regulations 2005 (IHR)
  .2 International Medical Guide for Ships (IMGS) and recommendations for the ship's medicine chest and equipment
  .3 International Maritime Organization's Medical First Aid Guide for Use in
  .4 Accidents Involving Dangerous Goods (MFAG)
  .5 WHO's Guidelines for Drinking-water quality
.7 Responsibilities under international instruments affecting the safety of the ship, passengers, crew or cargo
  .1 ILO's Maritime Labour Convention 2006 (MLC 2006)
  .2 International Convention on Salvage, 1989 – Lloyd's Standard Form of Salvage Agreement (LOF, 2000)
  .3 Convention on Limitation of Liability of Maritime Claims, 1976 (LLMC 1976)
  .4 Charter parties
  .5 Marine Insurance, General Average and P & I Club
.8 Methods and aids to prevent pollution of the environment by ships
  .1 List of Convention – (Refer 4.2.1.4 under "Conventions related to Marine Pollution")
  .2 Sources of Marine pollution
  .3 Effects of marine oil spills
  .4 Regulations for prevention of oil pollution as per Annex I of MARPOL 73/78
  .5 Regulations for control of pollution from noxious liquid substances carried in bulk as per Annex II of MARPOL 73/78
  .6 Regulations for the Prevention of Pollution by Harmful substances carried by sea in packaged form as per Annex III of MARPOL 73/78

.7 Requirements covering the carriage of dangerous goods by sea as per Chapter VII of the SOLAS Convention

.8 Regulations for the Prevention of Pollution by Sewage from Ships as per Annex IV of MARPOL 73/78

.9 Regulations for the Prevention of Pollution by Garbage from Ships as per Annex V of MARPOL 73/78

.10 Regulations for the Prevention of Air Pollution as per Annex VI of MARPOL 73/78

.11 International Convention for the Control and Management of Ship's Ballast Water and Sediment

.12 Anti-fouling paints

.13 Noise

.9 National legislation for implementing international agreements and conventions

4.3 **MAINTAIN SAFETY AND SECURITY OF THE VESSEL, CREW AND PASSENGERS AND THE OPERATIONAL CONDITION OF THE LIFE SAVING, FIRE FIGHTING AND OTHER SAFETY SYSTEM.**

.1 Life saving appliances regulations

.1 Life-saving appliances and arrangements (Chapter III of SOLAS) and Life Saving Appliance Code

.2 Organization of fire and abandon ship drills

.1 Organization of Fire and Abandon Ships Drills

.3 Maintenance of Life-saving, Fire-fighting and Other Safety Systems

.1 Maintenance of Life-saving, Fire-fighting and Other Safety Systems

.4 Actions to be taken to protect and safeguard all persons on board in emergencies

.1 Actions to protect and safeguard all persons on board in emergencies; Rescue of persons from a vessel in distress or from a wreck; and Man over board procedures

.5 Action to limit damage and salve the ship following fire explosion, collision of grounding

.1 Contingency plans for response to emergencies

.2 Means of limiting damage and salving the ship following a fire or explosion

.3 Procedures for abandoning ship

4.4 **DEVELOP EMERGENCY AND DAMAGE CONTROL PLANS AND HANDLE EMERGENCY SITUATION**

.1 Ship construction, including damage control

.2 Method and aids for fire prevention, detection and extinction

.1 Fire-fighting equipment

.3 Function and use of life saving appliances

.1 Life saving appliances

4.5 **USE LEADERSHIP AND MANAGERIAL SKILLS (EXCLUSIVE COURSE)**

.1 Knowledge of shipboard personnel management and training

.1 Task and workload management

.2 Knowledge and ability to apply effective resource management

.1 Application of effective resource management of a management level

.3 Knowledge and ability to apply decision-making technique

.1 Situation and risk assessment

.4 Development, Implementation, and oversight of standard operating procedures

.1 Development, Implementation, and oversight of standard operating procedures

SYLLABUS FOR ORAL EXAMINATION OF MARINE ENGINEER OFFICER CLASS II CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/2)

The syllabus for the oral examination shall cover the following functions;

Function 1. Marine engineering at the management level
Function 2. Electrical, electronic and control engineering at the management level
Function 3. Maintenance and repair at the management level
Function 4. Controlling the operation of ship and care for persons on board at the management level.

General outlines for Oral Syllabus

- Operation, maintenance and management of marine plant
- Management and organisation of the engine room department
- Safety and protection of personnel, machinery and environment
- Pumps and pumping systems
- Emergency procedures and the safe control and operation of machinery and equipment
- Suitable temporary and permanent repairs
- Machinery construction and installation
- Fire prevention, detection and extinction
- Factors affecting the transverse stability of the ship
- Electrical systems
- Control systems
- Collection and interpretation of machinery data and measurements
- Maritime law and regulations to be observed regarding pollution of the marine environment
- Training of engine room staff
- ISM Code and occupational health & safety

Note:

1. The above is a guideline only and the content of the individual oral examinations may vary. The examiner may not cover all areas noted.
2. The level of knowledge of the subjects list in detail syllabus may be lowered but shall be sufficient to enable the candidates to serve in the capacity of marine engineer officer Class II.

SYLLABUS FOR ORAL EXAMINATION OF MARINE ENGINEER OFFICER CLASS II CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/2)

1. **Boilers**
   - .1 Water gauge
     - .1 Local
     - .2 Remote
   - .2 Manhole doors
   - .3 Feed check V/Vs
   - .4 Blow down V/Vs
   - .5 Safety valves
   - .6 Operations
   - .7 Furnace purging
   - .8 Uptake fires
   - .9 Super heater fires
   - .10 Raising steam
   - .11 Shutting down, lay up
   - .12 Water testing
   - .13 Water hammer
   - .14 Priming and foaming
   - .15 Construction arrangement
   - .16 Automatic controls
   - .17 Survey
   - .18 Combustion
   - .19 Associated systems & equipment

2. **Diesel Propulsion**
   - .1 Operation
   - .2 Crankcase explosion
   - .3 Scavenge fires
   - .4 Air line explosion
   - .5 Manoeuvring
   - .6 Emergency
   - .7 Warming through
   - .8 Shutting down
   - .9 Parameters
   - .10 Fuel consumption
   - .11 Combustion
   - .12 Associated systems & equipment
   - .13 Slow, medium and high speed
   - .14 Manoeuvring controls
   - .15 Protection devices

.16 Construction
.17 Timing
.18 Lubrication
.19 Alignment
.20 Automation
.21 Clutches
.22 Gear boxes
.23 Vibration dampers
.24 Thrust bearing
.25 Turbochargers
.26 Diesel electric
.27 Survey
.28 Diesel alternators
.29 Water treatment

3. **Steam Propulsion**

.1 Operation
.2 Warming through
.3 Shutting down
.4 Manoeuvring
.5 Emergency
.6 Parameters
.7 Turbines
.8 Protection devices
.9 Thrust bearing
.10 Gland steam
.11 Flexible coupling
.12 Manoeuvring V/V
.13 Automation
.14 Protection devices
.15 Lubrication
.16 Impulse, reaction
.17 Gear boxes
.18 Alignment
.19 Survey
.20 Turbo electric
.21 Turbo alternators
.22 Operation and construction
.23 Associated systems & equipment

4. **Water Treatment**

.1 Evaporators
.2 Distillers
.3 Ion exchange
.4 Reverse osmosis

.5 Testing
.6 Chemicals

5. **Feed Systems**
.1 Arrangement
.2 Feed pumps
.3 De-aerators and heaters
.4 Air ejector
.5 Extraction pumps
.6 Condenser
.7 Water testing
.8 Auto controls
.9 Corrosion

6. **Steering Gear & Rudders**
.1 Emergency operation
.2 Construction
.3 Control
.4 Lubrication
.5 Survey

7. **Air Compressors**
.1 Safety devices
.2 Compressor
.3 Receiver
.4 Air line
.5 Operation
.6 Lubrication
.7 Starting air
.8 Service and control air
.9 Receivers
.10 Automation
.11 Survey

8. **Fire**
.1 Prevention
.2 Extinction
.3 Hoses, extinguishers
.4 BA sets
.5 Procedures
.6 Fixed installations
.7 Detection
.8 Sensors, systems
.9 UMS requirements
.10 Structural fire protection

9. **Pumping Systems**

.1 Fire main
.2 Oily water separator
.3 Bunkering
.4 Bilge and ballast systems
.5 Salt water system
.6 Fresh water cooling
.7 Sewage plant
.8 Fuel oil system
.9 Diesel oil system
.10 Inert gas system
.11 Lubricating oil system
.12 Cargo system
.13 Sanitary system
.14 Purifiers, clarifiers
.15 Heaters
.16 Pumps: positive displacement, etc

10. **Refrigeration Systems**

.1 Safety
.2 Direct and indirect expansion
.3 Air conditioning
.4 Compressors

11. **Materials**

.1 Properties
.2 Destructive & non-destructive testing

12. **Propellers & Thrusters**

.1 Fixed pitch
.2 Attachment
.3 Survey
.4 Controllable pitch
.5 Operating system
.6 Attachment
.7 Survey
.8 Stern tube bearing
.9 Screw shafts
.10 Cross thrusters
.11 Fixed and controllable pitch propeller
.12 Voith schneider, etc
.13 DP systems

13. **Dry Docking**

.1 Supply of fire fighting water
.2 Supply of electrical power
.4 Stability
.5 Measurement of wear down, clearances

.6 Measurement of alignment
.7 Certificates of survey
.8 Annual
.9 Safety equipment
.10 Safety construction
.11 Load line
.12 Classification
.13 Ships structure
.14 Corrosion, erosion
.15 Cavitations
.16 Mechanical damage
.17 Cleaning, protection

14. **Tanks**

.1 Safety precautions
.2 Entering
.3 Pressure testing
.5 Survey

15. **Stability**

.1 Free surface
.2 Damage control

16. **Electricity**

.1 Emergency generators
.2 Operation
.3 Construction
.4 Statutory requirements
.5 Testing
.6 Fault detection
.7 AC generators
.8 Operation
.9 Construction
.10 Control equipment
.11 Fault detection
.12 Protection devices
.13 DC generators
.14 AC generators
.15 Distribution
.16 Isolation
.17 Electric shock
.18 Protection devices
.19 Fault detection
.20 Main switchboard
.21 Emergency switchboard
.22 Distribution boards
.23 Flame proof
.24 Drip proof

.25 Intrinsically safe
.26 Transformers
.27 Two wire
.28 Non-earthed and earthed neutral
.29 Motors
.30 AC: single and three phase

17. **Deck Machinery**
.1 Davits
.2 Winches
.3 Windlass
.4 Cranes
.5 Derricks
.6 Hatches
.7 Other

18. **Automation & Control**
.1 Bridge control
.2 UMS
.3 Fault detection
.4 Requirement
.5 Transfer from manual to auto
.6 Measuring devices
.7 Testing
.8 Calibration
.9 Survey

19. **Machinery Records**
.1 Oil record book
.2 Log books
.3 Trend recording
.4 Official records
.5 Combustion analysis
.6 Condition monitoring

20. **International Conventions and Maritime Law**
.1 MARPOL, SOLAS
.2 ISM Code
.3 Marine Orders
.4 Other

21. **Management**
.1 Training of engine-room staff
.2 Management and organisation of ER staff/dept

ANNEX (F)

SYLLABUS FOR WRITTEN EXAMINATION OF MARINE ENGINEER OFFICER CLASS III CERTIFICATE OF COMPETENCY

(Workshop Skill Training Course)

(Under STCW Convention, Regulation III/1)

FUNCTION 1: MARINE ENGINEERING AT THE OPERATIONAL LEVEL

1.1 **OPERATE MAIN AND AUXILIARY MACHINERY AND ASSOCIATED CONTROL SYSTEMS**

- .1 Basic construction and operation principle of machinery system.
  - .1 Marine Diesel Engine
    - .1 Engine types
    - .2 Engine principles
    - .3 Large-bore two stroke
    - .4 Medium speed and high speed
  - .2 Marine Boiler
    - .1 Fuel atomization and combustion
    - .2 Boiler fundamentals
    - .3 Construction
    - .4 Mountings and steam distribution
  - .3 Shaft Installation and propeller
    - .1 Shaft installation
    - .2 Propeller
  - .4 Other Auxiliaries
    - .1 Pumps
    - .2 Refrigeration
    - .3 Air condition and ventilation
    - .4 Heat exchanger
    - .5 Evaporator and distillers
    - .6 Air compressor
    - .7 Purifier
  - .5 Steering gear
    - .1 Principle
- .2 Preparation, operation, fault detection and necessary measure to prevent damage for the following:
  - .1 Main engine and associated auxiliaries
  - .2 Steam boiler and associated auxiliaries and steam systems
  - .3 Auxiliary prime movers and associated systems
  - .4 Other auxiliaries
    - .1 Purifier and fuel oil treatment
    - .2 Air compressor
    - .3 Evaporator and distillers
    - .4 Refrigerator

1.2 **OPERATE FUEL, LUBRICATION, BALLAST AND OTHER PUMPING SYSTEMS AND ASSOCIATED CONTROL SYSTEMS**

- .1 Operation of pumping systems and routine pumping operations
  - .1 Pump Operations
- .2 Operation of bilge, ballast and cargo pumping systems
  - .1 Systems

FUNCTION 2: ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT THE OPERATIONAL LEVEL

2.1 Maintenance and repair of electrical and electronic equipment
- .1 Maintenance and repair
  - .1 Principles of maintenance
  - .2 Generator
  - .3 Switchboard
  - .4 Electrical motors
  - .5 Starters
- .2 Detection of electric malfunction and measures to prevent damage.
  - .1 Fault protection
  - .2 Fault location
- .3 Construction and operation of electrical testing and measuring equipment
  - .1 Testing and measuring
- .4 Electrical and simple electronic diagrams
  - .1 Diagrams and symbols

FUNCTION 3: MAINTENANCE AND REPAIR AT THE OPERATIONAL LEVEL

3.1 **APPROPRIATE USE OF HAND TOOLS, MACHINE TOOLS AND MEASURING INSTRUMENTS FOR FABRICATION AND REPAIR ON BOARD**
- .1 Characteristics and limitations of materials used in construction and repair of ships and equipment
  - .1 Basic metallurgy, metals and processes
  - .2 Properties and uses
  - .3 Non-metallic materials
- .2 Characteristics and limitations of processes used for fabrication and repair
  - .1 Process
  - .2 Heat treatment of carbon steel
- .3 Properties and parameters considered in the fabrication and repair of systems and components
  - .1 Materials under load
  - .2 Vibration
  - .3 Self-secured joints
  - .4 Permanent joints
  - .5 Bonding plastics
  - .6 Adhesive and bonding
  - .7 Pipe works
- .4 Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments
  - .1 Safety
- .5 Use of hand tools, machine tools and measuring instruments
  - .1 Hand tools
  - .2 Powered hand tools
  - .3 Machine tools
    - .1 Drilling machines
    - .2 Grinding machine
    - .3 Centre lathe
    - .4 Welding and soldering
      - a) Principles of electric arc welding
      - b) Principle of gas welding

c) Welding in low carbon steel
d) Common faults in welded joints
e) Thermal cutting
f) Inspection
g) Soldering
h) Safety and health when welding

.4 Measuring instrument

.6 Use of various types of sealants and packing

3.2 MAINTENANCE AND REPAIR OF SHIPBOARD MACHINERY AND EQUIPMENT

.1 Safety measures to be taken for repair and maintenance
- .1 ISM Code
- .2 SMS
- .3 Safety measure to be taken

.2. Appropriate basic mechanical knowledge and skills
- .1 Selection of appropriate tools and spare gears.
- .2 Thorough understanding of procedure for maintenance and repairs.
- .3 Basic workshop technology.

.3 Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment and The use of appropriate specialized tools and measuring instruments
- .1 Fastening.
- .2 Centrifugal pumps
- .3 Reciprocating pumps
- .4 Screw and gear pumps.
- .5 Valves.
- .6 Air compressors.
- .7 Heat exchangers.
- .8 Diesel engine.
- .9 Turbocharger.
- .10 Maintains Oil fuel burners and boiler
- .11 Pump shaft alignment adjustment procedures.
- .12 Pipes.
- .13 Refrigeration maintenance.
- .14 Oil fuel and lubricating system maintenance.
- .15 Deck machinery maintenance
- .16 Maintains steering gear.
- .17 Refurbishes Diesel engine components

3.3 BASIC ENGINEERING DRAWING

.1 Types of drawing

.2 Line works

.3 Pictorial projection

.4 Development

.5 Dimensioning

.6 Geometrical tolerance

.7 Limits and fits

.8 Engineering drawing practice

SYLLABUS FOR WRITTEN EXAMINATION OF MARINE ENGINEER OFFICER CLASS III CERTIFICATE OF COMPETENCY

(For Supporting Knowledge of Basic Marine Engineering Science Subjects)

(Under STCW Convention, Regulation III/1)

SUBJECT 1: MECHANICS

Class II level

1.1 Mass and Volume
1.2 Dynamics
1.3 Energy, Work and Power
1.4 Fluids
1.5 Statics
1.6 Hydrostatics
1.7 Hydraulics
1.8 Friction
1.9 Inertia
1.10 Circular Motion
1.11 Periodic Motion
1.12 Dynamics of rotation
1.13 Impulse and Momentum
1.14 Direct Stress and Strain
1.15 Strain energy
1.16 Stress in Pressure Vessels
1.17 Shear and Torsion
1.18 Shear Force and Bending Moments
1.19 Bending Beams
1.20 Combined Bending and Direct Stress

SUBJECT 2: MATHEMATICS

2.1 Calculations with positive and negative integers
2.2 Simplifying expressions
2.3 Indices
2.4 Calculation
2.5 Algebra
2.6 Geometry
2.7 Trigonometry
2.8 Mensuration
2.9 Graphs
2.10 Calculus.

SUBJECT 3: THERMODYNAMICS

Class II level

3.1 Heat
3.2 Thermodynamic Properties
3.3 Thermodynamic Energy
3.4 Energy Change
3.5 Heat Transfer
3.6 Vapours
3.7 Ideal Gases

3.8 Thermodynamic Processes
3.9 Work Transfer
3.10 Heat-Engine Cycle
3.11 Ideal Gas Cycle
3.12 Rankine Cycle
3.13 Marine Refrigeration Cycle
3.14 Reciprocating Internal-Combustion Engines
3.15 Air Compressors
3.16 Steady-Flow Energy Equation
3.17 First and Second Laws of Thermodynamics
3.18 Behavior of Gases
3.19 Thermal Efficiency
3.20 Steam Plant
3.21 Nozzles
3.22 Engine Trial Data
3.23 Refrigeration

SUBJECT 4: BASIC ENGINEERING DRAWING

4.1 Interpretation of machinery drawings and handbooks. piping. hydraulic and pneumatic diagrams.
- .1 Types of drawing
- .2 Line works
- .3 Pictorial projection
- .4 Development
- .5 Dimensioning
- .6 Geometrical tolerance
- .7 Limits and fits
- .8 Engineering drawing practice

ANCILLARY SUBJECTS:

ENGLISH

.1 Use English in written and oral form
- .1 Adequate knowledge of the English language to enable the officer to use engineering publication
  - .1 Use English in written and oral form to:
    - .1 perform the officer's duties;
    - .2 use general maritime vocabulary;
    - .3 use marine technical terminology;
    - .4 use manufacturers' manuals;
    - .5 use shipboard drawings;
    - .6 use other engineering publications.

INDUSTRIAL CHEMISTRY

.2 Industrial Chemistry
- .1 Chemical Fundamentals
- .2 Acidity/Alkalinity
- .3 Corrosion
- .4 Water Testing and Treatment
- .5 Introduction to Fuels and Lubricants

SYLLABUS FOR WRITTEN EXAMINATION OF MARINE ENGINEER OFFICER CLASS III CERTIFICATE OF COMPETENCY

(For Marine Engineering Technology Subjects)

(Under STCW Convention, Regulation III/1)

FUNCTION 1: MARINE ENGINEERING AT THE OPERATIONAL LEVEL

SUBJECTS. MARINE ENGINEERING KNOWLEDGE (GENERAL) AND MARINE ENGINEERING KNOWLEDGE(MOTOR)

1.1 MAINTAIN A SAFE ENGINEERING WATCH

.1 Thorough knowledge of Principles to be observed in keeping an engineering watch, including:

- .1 principles to be observed in an engineering watch at sea and in port
- .2 standards/regulations for
- .3 the importance, ordinance and arrangements of watch keeping

.2 Safety and emergency procedures; change-over of remote/automatic to local control of all systems

- .1 emergency in accordance with components of the machinery
- .2 impact of the emergency and countermeasures conforming to the emergency procedures
- .3 changeover of remote/automatic control to local operation
- .4 propulsion machinery can be isolated from the entire system and can be run manually
- .5 remedial/emergency procedures
- .6 procedures/measures with isolation of the component
- .7 recovery and malfunctions occurred in auxiliaries

.3 Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems

- .1 engine-room rounds
- .2 communication with bridge and chief engineer
- .3 responsibility in the safe navigation
- .4 the running parameters of machinery
- .5 evacuation route and installations/equipment for emergency
- .6 fire-extinguishing installations
- .7 immediate actions
- .8 necessary measures in the event of oil spill

.4 Engine-room resource management

- .1 ERM principles
- .2 ERM in terms of maintaining the safe engineering watch
- .3 the resources
- .4 the resource management
- .5 necessary to practice ERM
- .6 practicing ERM

1.2 **USE INTERNAL COMMUNICATION SYSTEMS**

.1 Operation of all internal communication systems on board

1.3 **OPERATE MAIN AND AUXILIARY MACHINERY AND ASSOCIATED CONTROL SYSTEMS**

.1 Basic construction and operation principles of machinery systems

.1 Marine diesel engine

.1 Diesel Engine Fuel Atomization

.2 Engine Types.

.3 Engine Principles.

.4 Large-Bore (two-stroke) Engine Details.

.5 Medium-speed and high-speed (four0stroke) diesel engine

.2 Marine boiler

.1 Steam Boiler Fuel Atomization and Combustion

.2 Auxiliary Boiler Fundamentals.

.3 Auxiliary Boiler Constructions.

.4 Auxiliary Boiler Mountings and Steam Distribution.

.3 Shafting installations, including propeller

.1 Shafting

.1 Alignment

.2 Shaft Strengths

.3 Controllable-pitch Propellers

.4 Thrust block

.5 Balancing

.6 Vibration and Noise

.2 Propellers

.1 Types and feature

.2 Material

.3 Parameter

.4 Fitting on shaft

.5 Controllable propeller

.4 Other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air conditioning and ventilation systems

.1 Types of Pumps and Principles.

.1 Principles

.2 Types of Pump

.2 Refrigeration

.1 Principles of Refrigeration.

.2 Refrigerating Compressor.

.3 Refrigerating System Component.

.4 Refrigerating System Brines.

.5 Cold Storage Spaces.

.3 Air condition and ventilation.

.4 Heat exchanger

.5 Evaporators and Distillers Principles.

.1 Flash Evaporators

.2 Multiple-effect evaporation

.6 Air Compressors and System Principles.

.1 Air compressor

.2 Air compressor and system principles

.7 Purifier and fuel oil treatment

.5 Steering gear
.1 Steering Gear Principles.
.2 Steering Gear Electrical Control.
.3 Steering Gear Hydraulic Control Systems.
.4 Hydraulic Power-Operated Rudder Systems.
.5 Hydraulic Power Rotary Pump
.6 Automatic control systems
.7 Fluid flow and characteristics of lubricating oil, fuel oil and cooling systems
.8 Deck machinery
.1 Windlass/ mooring winch
.2 Winch
.3 Boat winch

.2 Safety and emergency procedures for operation of propulsion plant machinery, including control systems
.1 Main Engine Auto-slow down and shut down
.2 Main Boiler Auto-shut down
.3 Power Failure (black out)
.4 Emergency procedure for Equipment/Installation

1.4 **OPERATE FUEL, LUBRICATION, BALLAST AND OTHER PUMPING SYSTEMS AND ASSOCIATED CONTROL SYSTEMS**

.1 Operational characteristics of pumps and piping systems, including control systems
.1 Pipes and Fittings
.2 Operation of pumping system
.3 Oily water separator or similar equipment requirement and operation

FUNCTION 2: ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT THE OPERATIONAL LEVEL

SUBJECT. MARINE ELECTRO TECHNOLOGY

2.1 **OPERATE ELECTRICAL , ELECTRONIC AND CONTROL SYSTEMS**

.1 Basic electrical engineering
.1 Electrical theory
.2 Fundamental of Alternating Current
.3 Generators
.4 Power distribution system
.5 Electrical motors
.6 Electrical motor starting methodologies
.7 High-Voltage Installations
.8 Lighting
.9 Cables
.10 Batteries

.2 Basic Electronics
.1 Electron theory
.2 Basic electronic circuit elements
.3 Electronic control equipment
.4 Flowchart for automatic and control systems

.3 Basic control engineering
  .1 Fundamentals of automatic control
  .2 Various automatic control
  .3 On-Off control
  .4 Sequential control
  .5 Proportional-Integral-Derivate (PID) control
  .6 Measurement of process value
  .7 Transmission of signals
  .8 Manipulator elements

2.2 MAINTENANCE AND REPAIR OF ELECTRICAL AND ELECTRONIC EQUIPMENT

.1 Safety requirements for working on shipboard electrical systems.

.2 Maintenance Repair
  .1 Principles of maintenance
  .2 Distribution system
  .3 D.C electrical system and equipment
.3 Detection of electric malfunction and measures to prevent damage.
  .1 Fault Protection
.4 Construction and operation of electrical testing and measuring Equipment
.5 Function and performance tests of the following equipment and their configuration:
  .1 Monitoring systems
  .2 Automatic control devices
  .3 Protective devices
.6 Electrical and simple electronic diagrams

FUNCTION 3: MAINTENANCE AND REPAIR AT THE OPERATIONAL LEVEL

SUBJECT: MARINE ENGINEERING KNOWLEDGE (GENERAL & MOTOR)

3.1 APPROPRIATE USE OF HAND TOOLS, MACHINE TOOLS AND MEASURING INSTRUMENTS FOR FABRICATION AND REPAIR ON BOARD

.1 Methods for carrying out safe emergency/temporary repairs
  .1 Differences between emergency/temporary repair and permanent repair
  .2 Material can be used for emergency/temporary repair for pipe, valve, cooler and boiler tubes
  .3 Method of emergency/temporary repair for sea and overboard valves
.2 Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments
  .1 Proper maintenance of tools
  .2 Proper usage of tools and carful attitude
.3 Use of hand tools, machine tools and measuring instruments
  .1 Power hand tools
.4 Use of various types of sealants and packing

3.2 **MAINTENANCE AND REPAIR OF SHIPBOARD MACHINERY AND EQUIPMENT**

.1 Safety measures to be taken for repair and maintenance, the safe isolation of shipboard machinery and equipment
- .1 ISM Code
- .2 SMS
- .3 Safety measure to be taken onboard

.2 Appropriate basic mechanical knowledge and skills
- .1 Operation mechanism and construction of machinery and equipment
- .2 Interpretation of drawing and instruction books

.3 Maintenance and repair including dismantling, adjustment and reassembling of machinery and equipment
- .1 Centrifugal pumps
- .2 Reciprocating pumps
- .3 Screw and gear pumps.
- .4 Valves.
- .5 Air compressors.
- .6 Heat exchangers.
- .7 Diesel engine.
- .8 Turbocharger.
- .9 Maintains Oil fuel burners and boiler
- .10 Pump shaft alignment adjustment procedures.
- .11 Pipes.
- .12 Refrigeration maintenance.
- .13 Oil fuel and lubricating system maintenance.
- .14 Deck machinery maintenance
- .15 Maintains steering gear.
- .16 Refurbishes Diesel engine components

.4 The use of appropriate specialized tools and measuring instrument

.5 Design characteristics and selection of materials in construction of equipment
- .1 Materials in Construction of Equipment
- .2 Design Characteristics
- .3 Design characteristics of Bearing

.6 Interpretation of piping, hydraulic and pneumatic diagrams

FUNCTION 4: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

SUBJECT: MARINE ENGINEERING KNOWLEDGE (GENERAL)

4.1 **ENSURE COMPLIANCE WITH POLLUTION PREVENTION REQUIREMENTS**

.1 The precautions to be taken to prevent pollution of the marine environment
- .1 MARPOL 73/78
  - .1 Annex I – Prevention of pollution by oil
  - .2 Annex II - Noxious Liquid Substances in Bulk
  - .3 Annex III – Harmful Substances Carried by Sea in Packaged forms, or in Freight Containers, Portable Tanks or Road and Rail Tank Wagons

.4 Annex IV - Sewage
.5 Annex V - Garbage
.6 Annex VI – Air Pollution

.2 Convention and legislations adopted by various countries

.2 Anti-pollution procedures and all associated equipment

.1 Control of discharge of oil

.2 Oil Record Book (Part I – Machinery Space Operations) and Part II – Cargo/Ballast operations)

.3 Shipboard Oil Pollution Emergency Plan (SOPEP) including Shipboard Marine Pollution Emergency Plans (SMPEP) for Oil and/or Noxious Liquid Substances and Vessel Response Plan (VRP)

.4 Operating procedures of anti-pollution equipment, Sewage plant, incinerator, comminutor, ballast water treatment plant

.5 Volatile Organic Compound (VOC) Management Plan, Garbage Management System, Anti-fouling systems, Ballast Water Management and their discharge criteria

.3 Importance of proactive measures to protect the marine environment

.1 Proactive measures to protect the marine environment.

SUBJECT. NAVAL ARCHITECTURE AND SHIP CONSTRUCTION

4.2 **MAINTAIN SEAWORTHINESS OF THE SHIP**

.1 Ship Stability

.1 Displacement
.2 Buoyancy
.3 Fresh Water Allowance
.4 Statical Stability
.5 Initial Stability
.6 Angles of Loll
.7 Curves of Statically Stability
.8 Movement of the Centre of Gravity
.9 List and its Correction
.10 Effect of Slack Tanks
.11 Trim
.12 Ships Stresses

.2 Ship construction

.1 Ship Dimensions and Form
.2 Hull Structure
.3 Bow and Stern
.4 Fittings
.5 Rudder and Propellers

.3 Load Lines and Draught Marks

SUBJECT: MARINE ENGINEERING KNOWLEDGE (GENERAL)

4.3 **PREVENT, CONTROL AND FIGHT FIRES ON BOARD**

.1 Ability to organize fire drills
.2 Knowledge of classes and chemistry of fire
.3 Knowledge of fire-fighting systems
.4 Action to be taken in the event of fire, including fires involving oil systems

4.4 **OPERATE LIFE-SAVING APPLIANCES**

.1 Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids.

4.5 **APPLY MEDICAL FIRST AID ON BOARD SHIP**

.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

4.6 **MONITOR COMPLIANCE WITH LEGISLATIVE REQUIREMENTS**

.1 Basic working knowledge of the relevant IMO conventions concerning safety of life at sea and protection of the marine environment

.1 Introduction to Maritime Law

.2 Law of the Sea

.3. Basic working knowledge of the relevant IMO conventions concerning safety of life at sea and protection of the marine environment including

.1 International Convention on Load Lines, 1966 (LL 1966), as amended

.2 International Convention for the Safety of life at Sea, 1974 as amended (SOLAS) – General Provisions

.3 SOLAS – Subdivision and Stability, Machinery and Electrical Installation

.4 SOLAS –Fire protection , fire Detection and fire Extinction

.5 SOLAS-Life-Saving Appliances and Arrangements (LSA Code)

.6 SOLAS - Carriage of Grain

.7 SOLAS - Carriage of Dangerous Goods

.8 The International Ship and Port Facility Code (ISPS Code)

.9 Code of Safe Working Practices for Merchant Seamen

.10 MLC-2006

.11 The International Safety Management (ISM) Code

4.7 **APPLICATION OF LEADERSHIP AND TEAM WORKING SKILLS**

.1 Working knowledge of shipboard personnel management and training

.1 Personnel Management

.2 Organization of Staff

.3 Manning Arrangements

.4 Analysis of Work

.5 Allocation of Staff

.6 Organizing for Safety and Emergencies

.7 Organizing for Staff Duties

.8 Organizing for Maintenance

.9 Ship's Records

.10 Organizing Communication on the Ship

.11 Meeting Techniques

.12 Training on Board Ships

.2 Knowledge of related international maritime conventions and national legislation

.3 Ability to apply task and workload management
- .1 planning and co-ordination
- .2 personnel assignment
- .3 time and resource constraints
- .4 prioritization

.4 Knowledge and ability to apply effective resource management
- .1 allocation, assignment, and prioritization of resources
- .2 effective communication on board and ashore
- .3 decisions reflect consideration of team experiences
- .4 assertiveness and leadership, including motivation
- .5 obtaining and maintaining situational awareness

.5 Knowledge and ability to apply decision-making technique
- .1 Situation and risk assessment
- .2 Identify and consider generated options
- .3 Selecting course of action
- .4 Evaluation of outcome effectiveness

4.8 **CONTRIBUTE TO THE SAFETY OF PERSONNEL AND SHIP**

.1 Knowledge of personal survival techniques

.2 Knowledge of fire prevention and ability to fight and extinguish fires

.3 Knowledge of elementary first aid

4 Knowledge of personal safety and social responsibilities

SYLLABUS FOR ORAL EXAMINATION OF MARINE ENGINEER OFFICER CLASS III CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/1)

Function 1. Marine engineering at operational level
Function 2. Electrical, electronic and control engineering at operation level
Function 3. Maintenance and repair at operational level
Function 4. Controlling the operation of ship and care for persons on board at operational level.

General outlines for Oral Syllabus

- Operation and maintenance of plant
- Management and organization of engine room watch
- Safety and protection of personnel, machinery and environment
- Location of common faults of machinery and plant and action necessary to prevent damage
- Pumps and pumping systems
- Emergency procedures and the safe control and operation of machinery and equipment
- Fire prevention, detection and extinction
- Factors affecting the transverse stability of the ship
- Electrical systems
- Safe isolation of electrical and other types of plant and equipment prior to maintenance
- Control systems
- Collection of machinery data and measurements
- Machinery construction
- Relevant international regulations, including pollution of the marine environment
- ISM Code and Operational Health and Safety

Note: The above is a guideline only and the content of the individual oral examinations may vary. The examiner may not cover all areas noted.

SYLLABUS FOR ORAL EXAMINATION OF MARINE ENGINEER OFFICER CLASS III CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/1)

1. Boilers

.1 Water gauge
  .1 Local
  .2 Remote
.3 Manhole doors
.4 Feed check V/Vs
.5 Blow down V/Vs
.6 Safety Valves
.7 Operations
.8 Furnace purging
.9 Uptake fires
.10 Super heater fires
.11 Raising steam
.12 Shutting down, lay up
.13 Water testing
.14 Water hammer
.15 Priming and foaming
.16 Construction arrangement
.17 Automatic controls
.18 Combustion
.19 Associated Systems & Equipment

2. Diesel Propulsion

.1 Operation
.2 Crankcase explosion
.3 Scavenge fires
.4 Air line explosion
.5 Manoeuvring
.6 Emergency
.7 Warming through
.8 Shutting down
.9 Parameters
.10 Fuel consumption
.11 Combustion
.12 Associated systems & equipment
.13 Slow, medium and high speed
.14 Manoeuvring controls
.15 Protection devices
.16 Construction
.17 Timing

.18 Lubrication
.19 Alignment
.20 Automation
.21 Clutches
.22 Gear boxes
.23 Vibration dampers
.24 Thrust bearing
.25 Turbochargers
.26 Diesel electric
.27 Diesel alternators
.28 Water treatment

3. Steam Propulsion

.1 Operation
.2 Warming through
.3 Shutting down
.4 Manoeuvring
.5 Emergency
.6 Parameters
.7 Turbines
.8 Protection devices
.9 Thrust bearing
.10 Gland steam
.11 Flexible coupling
.12 Manoeuvring V/V
.13 Automation
.14 Protection devices
.15 Lubrication
.16 Impulse, reaction
.17 Gear boxes
.18 Turbo electric
.19 Turbo alternators
.20 Operation and construction
.21 Associated systems & equipment

4. Water Treatment

.1 Evaporators
.2 Distillers
.3 Ion exchange
.4 Reverse osmosis
.5 Testing
.6 Chemicals

5. Feed Systems

.1 Arrangement
.2 Feed pumps

.3 De-aerators and heaters
.4 Air ejector
.5 Extraction pumps
.6 Condenser
.7 Water testing
.8 Auto controls

6. Steering Gear & Rudders

.1 Emergency operation
.2 Construction
.3 Control
.4 Lubrication

7. Air Compressors

.1 Safety devices
.2 Compressor
.3 Receiver
.4 Air line
.5 Operation
.6 Lubrication
.7 Starting air
.8 Service and control air
.9 Receivers
.10 Automation

8. Fire

.1 Prevention
.2 Extinction
.3 Hoses, extinguishers
.4 BA sets
.5 Procedures
.6 Fixed installations
.7 Detection
.8 Sensors, systems
.9 UMS requirements
.10 Structural fire protection

9. Pumping Systems

.1 Fire main
.2 Oily water separator
.3 Bunkering
.4 Bilge and ballast systems
.5 Salt water system
.6 Fresh water cooling
.7 Sewage plant
.8 Fuel oil system

.9 Diesel oil system
.10 Inert gas system
.11 Lubricating oil system
.12 Cargo system
.13 Sanitary system
.14 Purifiers, clarifiers
.15 Heaters
.16 Pumps: positive displacement, etc

10. Refrigeration Systems

.1 Safety
.2 Direct and indirect expansion
.3 Air conditioning
.4 Compressors

11. Materials

.1 Properties
.2 Destructive & non-destructive testing

12. Propellers & Thrusters

.1 Fixed pitch
.2 Controllable pitch
.3 Operating system
.4 Stern tube bearing
.5 Screw shafts
.6 Cross thrusters
.7 Fixed and CP prop
.8 Voith Schneider, etc
.9 DP systems

13. Dry Docking

.1 Supply of fire fighting water
.2 Supply of electrical power
.4 Stability
.5 Ship Structure

14. Tanks

.1 Safety precautions
.2 Entering

15. Stability

.1 Free surface
.2 Damage control

16. Electricity

.1 Emergency generators
.2 Operation
.5 Testing

.6 Fault detection
.7 AC generators
.8 Operation
.9 Construction
.10 Control equipment
.11 Fault detection
.12 Protection devices
.13 DC generators
.14 as per AC
.15 Distribution
.16 Isolation
.17 Electric shock
.18 Protection devices
.19 Fault detection
.20 Main switchboard
.21 Emergency switchboard
.22 Distribution boards
.23 Flame proof
.24 Drip proof
.25 Intrinsically safe
.26 Transformers
.27 Two wire
.28 Non-earthed and earthed neutral
.29 Motors
.30 DC Series shunt compound
.31 AC: single and three phase

17. Deck Machinery

.1 Davits
.2 Winches
.3 Windlass
.4 Cranes
.5 Derricks
.6 Hatches
.7 Other

18. Automation & Control

.1 Bridge control
.2 UMS
.3 Fault detection
.4 Transfer from manual to auto
.5 Measuring devices
.6 Testing
.7 Calibration

19. **Machinery Records**

.1 Oil record book

.2 Log books

.3 Trend recording

.4 Official records

20. **International Conventions and Maritime Law**

.1 MARPOL, SOLAS

.2 ISM Code

.3 Marine notifications, circulars

.4 Other

21. **Management**

.1 Training of Engine-room staff

.2 Management and organization of ER staff/dept

ANNEX (G)

SYLLABUS FOR WRITTEN EXAMINATION OF MARINE ENGINEER OFFICER CLASS IV & V CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/3)

FUNCTION 1: MARINE ENGINEERING AT MANAGEMENT LEVEL

SUBJECTS: MARINE ENGINEERING KNOWLEDGE (GENERAL), MARINE ENGINEERING KNOWLEDGE (MOTOR) AND NAVAL ARCHITECTURE AND SHIP CONSTRUCTION

1.1 **OPERATION OF PROPULSION PLANT MACHINERY**

- .1 Design features and operative mechanism of the marine diesel engine
  - .1 Engine Components.
    - .1 Bed plate
    - .2 Tie bolt
    - .3 Cylinder liner
    - .4 Piston
  - .2 Engine lubrication.
  - .3 Fuel injection.
  - .4 Scavenging and supercharging.
    - .1 Two-stroke engines
  - .5 Starting and reversing
  - .6 Cooling systems.
  - .7 Diesel engine control.
  - .8 Multi-engine propulsion arrangement.
- .2 Design features and operative mechanism of the marine steam turbine
  - .1 Design features
  - .2 Operation
- .3 Design features and operative mechanism of the marine gas turbine
  - .1 Design features
  - .2 Operation
- .4 Design features and operative mechanism of the marine steam boiler
  - .1 Waste heat utilization.
  - .2 Types of boiler.
  - .3 Safety valves.
  - .4 Boiler water levels.
  - .5 Boiler defects.
  - .6 Corrosion in boilers.
  - .7 Use of seawater in boilers.
  - .8 Use of fresh water in boilers.
  - .9 Water treatment.
  - .10 Water testing.

1.2 **PLAN AND SCHEDULE OPERATIONS**

.1 Refrigeration and air conditioning
- .1 Shipboard plant
- .2 System performance
  - .1 Operational problems
  - .2 Rectifying the problems
- .3 Brine and brine systems.
- .4 Carriage of refrigerated cargo
- .5 Air conditioning and ventilation.

.2 Physical and Chemical properties of fuels and lubricants
- .1 Production of oils from crude oil.
- .2 Physical and chemical properties of oils.
- .3 Combustion.
  - .1 Combustion equipment.
- .4 Oil purification.
- .5 Lubricating oils.
- .6 Lubrication.
- .7 Lubrication problems and testing.
- .8 Greases.

.3 Technology of materials
- .1 Metallurgy of steel and cast iron.
- .2 Testing and properties of materials
- .3 Heat treatment of metals
- .4 Alloying elements in irons and steels
- .5 Non-ferrous metals
- .6 Non-metallic materials
- .7 Welding

.4 Naval architecture and ship construction, including damage control
- .1 Movement of the centre of gravity
- .2 Flotation
- .3 Transverse statical stability
- .4 Effect of liquids on stability
- 5 Correcting the angle of loll
- .6 TPC and displacement curves
- .7 Form coefficients
- .8 Areas and volumes of ship shapes
- .9 KB. BM and meta-centric diagrams
- .10 List
- .11 Moments of statical stability
- .12 Trim
- .13 Dry-docking and grounding
- .14 Damage control
- .15 Ship motion

.16 Vibration in ships
.17 Rudders
.18 Resistance, powering and fuel consumption
.19 Propulsion and propellers
.20 Ship structures

1.3 OPERATION, SURVEILLANCE, PERFORMANCE ASSESSMENT AND MAINTAINING SAFETY OF AUXILIARY MACHINERY

.1 Start up and shut down, operating limits of auxiliary machinery, the efficient operation, surveillance, performance assessment and maintaining safety of auxiliary machinery.
  .1 Air compressors
    .1 P-V diagram
    .2 Construction of multi-stage air compressor
    .3 Inter-cooler and after-cooler
    .4 Lubrication
    .5 Safety devices
    .6 Operation of multi-stage air compressor
  .2 Principles of operation of evaporators
    .1 Evaporator materials
    .2 Control of evaporators
  .3 Steering gear
  .4 Shafting
  .5 Controllable-pitch propellers
  .6 Torsion-meter
  .7 Thrust block
  .8 Balancing
  .9 Vibration and noise
2 Functions and mechanism of automatic control for auxiliary machinery
  .1 Deck machinery
  .2 Warping winches and capstans
  .3 Steering gear
    .1 Steering gear control systems
  .4 Controllable-pitch propellers

1.4 MANAGE FUEL, LUBRICATION AND BALLAST OPERATIONS

.1 Operation and maintenance of machinery, including pumps and piping systems
  .1 Ballast
  .2 Bilge
  .3 Fire main
  .4 Prevention of pollution of the sea by oil
  .5 Sewage and sludge
  .6 Air pollution

FUNCTION 2: ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT THE MANAGEMENT LEVEL

SUBJECT: MARINE ELECTRO-TECHNOLOGY

2.1 **MANAGE OPERATION OF ELECTRICAL AND ELECTRONIC CONTROL EQUIPMENT**

.1 Marine electro-technology, electronics, power electronics, automatic control engineering and safety devices
- .1 Application of ohm's and kirchhoff's laws
- .2 Electromagnetism

.2 Design features and system configurations of automatic control equipment and safety devices for main engine. Generator and distribution system and steam boiler and electrical motors
- .1 Control theory
  - .1 Proportional action
  - .2 Integral action
  - .3 Proportional plus integral action
  - .4 Derivative action
  - .5 Proportional plus derivative action
  - .6 Proportional plus derivative plus integral action
  - .7 Split-range control
  - .8 Cascade control
- .2 Practical work
  - .1 Problems related to semiconductor devices used in electronic circuits. Practical work on electronic circuits used in machinery control and alarm system.

.3 Design features of high-voltage installation
- .1 The function, operation and safety requirements
- .2 Maintenance, fault finding, isolating, testing and repair of high-voltage switchgear

.4 Features of hydraulic and pneumatic control equipment
- .1 Features of hydraulic and pneumatic control equipment

2.2 **MANAGE TROUBLESHOOTING, RESTORATION OF ELECTRICAL AND ELECTRONIC CONTROL EQUIPMENT TO OPERATING CONDITION** ***(Practical knowledge)***

.1 Troubleshooting and function test of electrical and electronic control equipment safety devices and monitoring systems, software version control
- .1 Power factor improvement
- .2 Poly-phase supplies
  - .1 Star connection
  - .2 Delta connection
  - .3 Power
- .3 A.C. generators
  - .1 Principle of construction
  - .2 Excitation
  - .3 Shaft-driven generators

.4 Automatic voltage regulation
.5 A.C. Switchgear
.1 Methods of closing circuit breakers
.2 Maintenance of circuit breakers
.6 Generator protection
.7 Single and parallel operation of generator
.8 Transformers
.9 Rectification
.10 Distribution
.11 Circuit protection
.1 Shore supply
.2 Emergency stop controls
.12 Cables
.1 Flexible cords and cables
.2 Cable runs
.13 D.C. and A. C. motors
.1 D. C. motors
.2 A. C. motors
.3 Varying supply
.4 Maintenance
.14 Motor control and protection
.1 Purpose of protection
.2 D. C. motors
.3 A. C. motors
.4 Maintenance
.15 Cells and batteries
.1 Batteries
.16 Lamps
.17 Tankers, electrical safety systems

FUNCTION 3: MAINTENANCE AND REPAIR AT THE MANAGEMENT LEVEL

SUBJECTS: MARINE ENGINEERING KNOWLEDGE (GENERAL) AND MARINE ENGINEERING KNOWLEDGE (MOTOR)

3.1 **SAFE AND EFFECTIVE MAINTENANCE AND REPAIR PROCEDURES**

.1 Marine Engineering Practice, Safe and effective maintenance and repair procedures, Planning maintenance and repairs
.1 Preparation for maintenance
.2 Planned maintenance
.1 Practical knowledge
.2 Planned maintenance, dismantling and inspection
.3 Planned maintenance assembly and testing

3.2 **DETECT AND IDENTIFY THE CAUSE OF MACHINERY MALFUNCTIONS AND CORRECT FAULTS**

.1 Detect and identify the cause of machinery malfunctions and correct faults, inspection and adjustment, Non-destructive examination

.1 Unplanned maintenance

3.3 **ENSURE SAFE WORKING PRACTICES**

1 Safe working practices

.1 Safety management

.1 Pressure vessel and pipe work maintenance

FUNCTION 4: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

SUBJECT: NAVAL ARCHITECTURE AND SHIP CONSTRUCTION

4.1 **CONTROL TRIM, STABILITY AND STRESS**

.1 Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability

.1 Shipbuilding materials
.2 Welding
.3 Bulkheads
.4 Watertight and weather-tight doors
.5 Corrosion and prevention
.6 Surveys and dry-docking
.7 Stability
.1 Effects of density
.2 Stability at moderate and large angles of heel
.3 Simplified stability data
.4 Trim and list
.5 Dynamical stability
.6 Approximate GM by means of rolling period tests
.7 Inclining test
.8 Recommendation on intact stability for passenger and cargo ships under 100 metres in length
.9 Intact stability requirements for the carriage of grain
.10 Rolling of ships
.11 Dry-docking and grounding
.12 Shear force. bending moments and torsional stress

.2 Knowledge of the effect on trim and stability of a ship in the event of damage to and consequent flooding of a compartment and countermeasures to be taken

.1 Effect of flooding on transverse stability and trim
.1 effect of flooding on trim
.2 Theories affecting trim and stability

.3 Knowledge of IMO recommendations concerning ship stability

.1 Responsibilities under the relevant requirements of the international conventions and codes

Minimum stability requirements required by load line rules 1966. Correct use of IMO grain regulations. Usage of grain heeling moment information. Requirements for passenger ship stability after damage. How the effects of steady and gusting winds are determined. Minimum IMO stability requirements with respect to wind heeling under current regulations.

4.2 DEVELOP EMERGENCY AND DAMAGE CONTROL PLANS AND HANDLE EMERGENCY SITUATIONS

.1 Ship construction, including damage control

.1 Flooding of compartments

Margin line, permeability of a space, floodable length, permissible length of compartments in passenger ships, factor of subdivision, assumed extent of damage, provisions for dealing with asymmetrical flooding, final condition of the ship after assumed damage and equalization of flooding, data necessary to maintain sufficient intact stability to withstand the critical damage, possible effects of sustaining damage, computation of freeboard, extent of damage which a type 'A' ship of over 150 metres length should withstand, "One compartment ship", requirements for survivability of Type 'B' ships with reduced freeboard assigned, equilibrium conditions regarded as satisfactory after flooding, damage to compartments which cause a ship to sink as a result of (a) insufficient reserve buoyancy, leading to progressive flooding, (b) progressive flooding due to excessive list or trim, (c) capsizing due to loss of stability (d) structural failure

SUBJECT: MARINE ENGINEERING KNOWLEDGE (GENERAL)

4.3 MONITOR AND CONTROL COMPLIANCE WITH LEGISLATIVE REQUIREMENTS AND MEASURES TO ENSURE SAFETY OF LIFE AT SEA AND PROTECTION OF THE MARINE ENVIRONMENT

.1 Knowledge of relevant international maritime law embodied in international agreements and conventions

.1 Certificates and other documents required to be carried on board ships by International Conventions

.2 Responsibilities under the relevant requirements of the International Convention on load lines

.3 Responsibilities under the relevant requirements of the International Convention for the safety of life at sea

.4 Responsibilities under the International Convention for the prevention of pollution from ships

Annex I-Oil

Annex II Noxious Liquid Substances in Bulk

Annex III - Harmful Substances Carried by Sea in Packaged Forms. or in Freight Containers. or Tank Wagons

Annex IV - Sewage

Annex V - Garbage

Annex VI - Air

NOx, SOx and carbon emission from ship, Effects by sulphur contents in oil

.5 Maritime declarations of health and the requirements of the International Health Regulations

.6 Responsibilities under international instruments affecting the safety of the ships, passengers, crew or cargo

ILO's Maritime Labour Convention 2006 (MLC 2006)

International Convention for the Unification of Certain Rules of Law with Respect to Collision Between Vessels (Collision. 1910)

International Convention on Salvage. 1989 (The London Salvage Convention)

Lloyd's Standard Form of Salvage Agreement (LOF. 1995)

Convention on Limitation of Liability for Maritime Claims. 1976 (LLMC 1976)

Classification Societies

International Convention for the Unification of Certain Rules of Law Relating to Bills of Loading. as Amended by the Protocol of 1968 (Hague-Visby Rules)

Charter-Parties

Hamburg Rules' Maritime Legislation

General Average and Marine Insurance The York-Antwerp Rules. 1974

Marine Insurance

.7 Methods and aids to prevent pollution of the environment by ships

Convention of the Prevention of Marine Pollution by Dumping of R21 Wastes and Other Matter (London Dumping Convention) (LDC)

International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties. 1969

Protocol relating to Intervention on the High Seas in Cases of Pollution by Substances other than Oil. 1973

International Convention on Civil Liability for Oil Pollution Damage. 1969 (CLC 1969)

.8 Knowledge of national legislation for implementing international agreements and conventions

4.4 **MAINTAIN SAFETY AND SECURITY OF THE VESSEL. CREW AND PASSENGERS AND THE OPERATIONAL CONDITION OF LIFE-SAVING. FIRE-FIGHTING AND OTHER SAFETY SYSTEMS**

.1 Knowledge of life-saving appliance regulations (International Convention for the Safety of Life at Sea)

.1 Regulations concerning life-saving appliances and arrangements (SOLAS). including the LSA Code

.2 Organization of fire and abandon ship drills

See IMO Model Courses 1.23 Proficiency in survival craft and rescue boats (not fast rescue boats) and 2.03 advanced training in fire fighting course.

.3 Maintenance of operational condition of life-saving. Fire-fighting and other safety systems

See IMO Model Courses 1.23 proficiency in survival craft and rescue boats (not fast rescue boats) and 2.03 advanced training in fire fighting course.

.4 Actions to be taken to protect and safeguard all persons on board in emergencies

.1 Actions to protect and safeguard all persons on board in emergencies

Specific assignment to some crew members for mustering and control of passengers. List of those duties.

Rescue of Persons from a Vessel in Distress or from a Wreck

Man-overboard Procedure

.2 Contingency plans for response to emergencies.

Actions to be Taken when Emergencies Arise in Port

Actions to take in the event of fire on own ship. with particular reference to co-operation with shore facilities. Action which should be taken when fire occurs on a nearby ship or an adjacent port facility. Circumstances in which a ship should put to sea for reasons of safety. Actions which can be taken to avoid a ship dragging anchor towards own ship in an anchorage. Actions and precautions to take when a submarine cable is lifted by the anchor. How to buoy and slip an anchor. How an anchor may be recovered when no power is available at the windlass

.5 Actions to limit damage and salve the ship following fire. explosion. collision or grounding

.1 Actions to limit damage and salve the ship following fire. explosion. collision or grounding

Means of limiting damage and salving the ship following a fire or explosion

Methods of fighting fires (see IMO Model Course 2.03. Advanced Training in Fire Fighting). Cooling of compartment boundaries where fire has occurred. Dangers of accumulated water from fire fighting and dealing with it. Watch for re-ignition. Precautions to take before entry to a compartment where a fire has been extinguished. Inspection for damage. Measures which may be taken to limit ingress of water through a damaged deck or superstructure. Measures to be taken when the inert-gas main and gas lines to a mast riser are fractured. Continuous watch kept on the damaged area and temporary repairs. Course and speed to be adjusted to minimise stresses and the shipping of water.

Procedure for Abandoning Ship

Circumstances that ship should be abandoned. Distress call until acknowledged. Information to include in the distress message. Other distress signals which may be used to attract attention. Launching of boats and life-rafts when the ship is listing heavily. Launching of boats and life-rafts in heavy weather conditions. Use of oil to calm the sea surface and why fuel oil is not suitable.

4.5 DEVELOP EMERGENCY AND DAMAGE CONTROL PLANS AND HANDLE EMERGENCY SITUATIONS

Methods and aids for fire prevention. detection and extinction

See IMO Model Course 2.03

Functions and use of life-saving appliances

See IMO Model Course 1.23

4.6 USE LEADERSHIP AND MANAGERIAL SKILLS

1 Knowledge of shipboard personnel management and training

.1 Personnel Management

Principles of controlling subordinates and maintaining good relationships. Staff attitudes. Exercise of authority. Group behaviour. Conditions of employment.

Organization of staff

Manning arrangements. Analysis of work. Allocation of staff. Organizing for safety and emergencies. Organizing for staff duties. Organizing for maintenance. Ship's records. Organizing communication on the ship. Meeting techniques.

.2 Training on board ships

Training methods. Emergency drills.

.2 Acknowledge of international maritime conventions and recommendations, and related national legislation

The ISM Code.

Principles underlying the ISM Code. Content and application of the ISM Code

STCW Convention

Principles underlying the STCW Convention. Content and application of the STCW Convention. Principle of Port State Control with particular reference to: operation of above. terms of reference. master's responsibility and legal standpoint. Regulations for controlling and monitoring to minimum hours of rest for watch-keepers. Seafarers' watch-keeping certificates. Requirements for seafarers new to a particular type of vessel. Shipboard familiarization for watch-keeping officers. Safety familiarization for a watch-keeping officer. How to organize shipboard training and how to maintain records.

.3 Ability to apply task and workload management.

Planning and coordination. Personnel assignment. Time and resource constraints. Prioritization

.4 Knowledge and ability to apply effective resource management

Allocation. Assignment, and prioritization of resources. Effective communication on board and ashore. Decisions reflect consideration of team experience

.5 Knowledge and ability to apply decision-making techniques

Situation and risk assessment, Identify and generate options, Select course of action, Evaluation of outcome

.6 Effectiveness Development, implementation, and oversight of standard operating procedures

Organization of Staff

SYLLABUS FOR ORAL EXAMINATION OF MARINE ENGINEER OFFICER CLASS IV CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/3)

Function 1. Marine engineering at the management level
Function 2. Electrical, electronic and control engineering at the management level
Function 3. Maintenance and repair at the management level
Function 4. Controlling the operation of ship and care for persons on board at the management level.

General outlines for Oral Syllabus

- Operation, maintenance and management of marine plant
- Management and organisation of the engine room department
- Safety and protection of personnel, machinery and environment
- Pumps and pumping systems
- Emergency procedures and the safe control and operation of machinery and equipment
- Suitable temporary and permanent repairs
- Machinery construction and installation
- Fire prevention, detection and extinction
- Factors affecting the transverse stability of the ship
- Electrical systems
- Control systems
- Collection and interpretation of machinery data and measurements
- Maritime law and regulations to be observed regarding pollution of the marine environment
- Training of engine room staff
- ISM Code and Occupational Health & Safety

Note:

1. The above is a guideline only and the content of the individual oral examinations may vary. The examiner may not cover all areas noted.
2. The level of knowledge of the subjects list in detail syllabus may be lowered but shall be sufficient to enable the candidates to serve in the capacity of Marine Engineer Officer Class IV.

SYLLABUS FOR ORAL EXAMINATION OF MARINE ENGINEER OFFICER CLASS IV CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/3)

1. Boilers

.1 Water gauge
  .1 Local
  .2 Remote
.2 Manhole doors
.3 Feed check V/Vs
.4 Blow down V/Vs
.5 Safety valves
.6 Operations
.7 Furnace purging
.8 Uptake fires
.9 Super heater fires
.10 Raising steam
.11 Shutting down, lay up
.12 Water testing
.13 Water hammer
.14 Priming and foaming
.15 Construction arrangement
.16 Automatic controls
.17 Survey
.18 Combustion
.19 Associated systems & equipment

2. Diesel Propulsion

.1 Operation
.2 Crankcase explosion
.3 Scavenge fires
.4 Air line explosion
.5 Manoeuvring
.6 Emergency
.7 Warming through
.8 Shutting down
.9 Parameters
.10 Fuel consumption
.11 Combustion
.12 Associated systems & equipment
.13 Slow, medium and high speed
.14 Manoeuvring controls
.15 Protection devices
.16 Construction

.17 Timing
.18 Lubrication
.19 Alignment
.20 Automation
.21 Clutches
.22 Gear boxes
.23 Vibration dampers
.24 Thrust bearing
.25 Turbochargers
.26 Diesel electric
.27 Survey
.28 Diesel alternators
.29 Water treatment

3. Steam Propulsion

.1 Operation
.2 Warming through
.3 Shutting down
.4 Manoeuvring
.5 Emergency
.6 Parameters
.7 Turbines
.8 Protection devices
.9 Thrust bearing
.10 Gland steam
.11 Flexible coupling
.12 Manoeuvring V/V
.13 Automation
.14 Protection devices
.15 Lubrication
.16 Impulse, reaction
.17 Gear boxes
.18 Alignment
.19 Survey
.20 Turbo electric
.21 Turbo alternators
.22 Operation and construction
.23 Associated systems & equipment

4. Water Treatment

.1 Evaporators
.2 Distillers
.3 Ion exchange
.4 Reverse osmosis
.5 Testing
.6 Chemicals

5. **Feed Systems**

.1 Arrangement
.2 Feed pumps
.3 De-aerators and heaters
.4 Air ejector
.5 Extraction pumps
.6 Condenser
.7 Water testing
.8 Auto controls
.9 Corrosion

6. **Steering Gear & Rudders**

.1 Emergency operation
.2 Construction
.3 Control
.4 Lubrication
.5 Survey

7. **Air Compressors**

.1 Safety devices
.2 Compressor
.3 Receiver
.4 Air line
.5 Operation
.6 Lubrication
.7 Starting air
.8 Service and control air
.9 Receivers
.10 Automation
.11 Survey

8. **Fire**

.1 Prevention
.2 Extinction
.3 Hoses, extinguishers
.4 BA sets
.5 Procedures
.6 Fixed installations
.7 Detection
.8 Sensors, systems
.9 UMS requirements
.10 Structural fire protection

9. **Pumping Systems**

.1 Fire main
.2 Oily water separator

.3 Bunkering
.4 Bilge and ballast systems
.5 Salt water system
.6 Fresh water cooling
.7 Sewage plant
.8 Fuel oil system
.9 Diesel oil system
.10 Inert gas system
.11 Lubricating oil system
.12 Cargo system
.13 Sanitary system
.14 Purifiers, clarifiers
.15 Heaters
.16 Pumps: positive displacement, etc

10. Refrigeration Systems

.1 Safety
.2 Direct and indirect expansion
.3 Air conditioning
.4 Compressors

11. Materials

.1 Properties
.2 Destructive & non-destructive testing

12. Propellers & Thrusters

.1 Fixed pitch
.2 Attachment
.3 Survey
.4 Controllable pitch
.5 Operating system
.6 Attachment
.7 Survey
.8 Stern tube bearing
.9 Screw shafts
.10 Cross thrusters
.11 Fixed and CP prop
.12 Voith schneider, etc
.13 DP systems

13. Dry Docking

.1 Supply of fire fighting water
.2 Supply of electrical power
.4 Stability
.5 Measurement of wear down, clearances
.6 Measurement of alignment

.7 Certificates of survey
.8 Annual
.9 Safety equipment
.10 Safety construction
.11 Load line
.12 Classification
.13 Ships structure
.14 Corrosion, erosion
.15 Cavitation
.16 Mechanical damage
.17 Cleaning, protection

14. Tanks

.1 Safety precautions
.2 Entering
.3 Pressure testing
.5 Survey

15. Stability

.1 Free surface
.2 Damage control

16. Electricity

.1 Emergency generators
.2 Operation
.3 Construction
.4 Statutory requirements
.5 Testing
.6 Fault detection
.7 AC generators
.8 Operation
.9 Construction
.10 Control equipment
.11 Fault detection
.12 Protection devices
.13 DC generators
.14 as per AC
.15 Distribution
.16 Isolation
.17 Electric shock
.18 Protection devices
.19 Fault detection
.20 Main switchboard
.21 Emergency switchboard
.22 Distribution boards
.23 Flame proof

.24 Drip proof
.25 Intrinsically safe
.26 Transformers
.27 Two wire
.28 Non-earthed and earthed neutral
.29 Motors
.30 AC: single and three phase

17. Deck Machinery

.1 Davits
.2 Winches
.3 Windlass
.4 Cranes
.5 Derricks
.6 Hatches
.7 Other

18. Automation & Control

.1 Bridge control
.2 UMS
.3 Fault detection
.4 Requirement
.5 Transfer from manual to auto
.6 Measuring devices
.7 Testing
.8 Calibration
.9 Survey

19. Machinery Records

.1 Oil record book
.2 Log books
.3 Trend recording
.4 Official records
.5 Combustion analysis
.6 Condition monitoring

20. Maritime Law

.1 MARPOL, SOLAS
.2 ISM code
.3 Marine orders
.4 Other

21. Management

.1 Training of engine-room staff
.2 Management and organization of ER staff/dept

SYLLABUS FOR ORAL EXAMINATION OF MARINE ENGINEER OFFICER CLASS V CERTIFICATE OF COMPETENCY (Under STCW Convention, Regulation III/3)

Function 1. Marine engineering at the management level
Function 2. Electrical, electronic and control engineering at the management level
Function 3. Maintenance and repair at the management level
Function 4. Controlling the operation of ship and care for persons on board at the management level.

General outlines for Oral Syllabus

- Operation and maintenance of plant
- Management and organization of engine room watch
- Safety and protection of personnel, machinery and environment
- Location of common faults of machinery and plant and action necessary to prevent damage
- Pumps and pumping systems
- Emergency procedures and the safe control and operation of machinery and equipment
- Fire prevention, detection and extinction
- Factors affecting the transverse stability of the ship
- Electrical systems
- Safe isolation of electrical and other types of plant and equipment prior to maintenance
- Control systems
- Collection of machinery data and measurements
- Machinery construction
- Relevant international regulations, including pollution of the marine environment
- ISM Code and Occupational Health & Safety

Note:

3. The above is a guideline only and the content of the individual oral examinations may vary. The examiner may not cover all areas noted.
4. The level of knowledge of the subjects list in detail syllabus may be lowered but shall be sufficient to enable the candidates to serve in the capacity of Marine Engineer Officer Class V.

SYLLABUS FOR ORAL EXAMINATION OF MARINE ENGINEER OFFICER CLASS V CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/3)

1. Boilers

.1 Water gauge
  .1 Local
  .2 Remote
.2 Manhole doors
.3 Feed check V/Vs
.4 Blow down V/Vs
.5 Safety valves
.6 Operations
.7 Furnace purging
.8 Uptake fires
.9 Super heater fires
.10 Raising steam
.11 Shutting down, lay up
.12 Water testing
.13 Water hammer
.14 Priming and foaming
.15 Construction arrangement
.16 Automatic controls
.17 Combustion
.18 Associated systems & equipment
.19 Survey

2. Diesel Propulsion

.1 Operation
.2 Crankcase explosion
.3 Scavenge fires
.4 Air line explosion
.5 Manoeuvring
.6 Emergency
.7 Warming through
.8 Shutting down
.9 Parameters
.10 Fuel consumption
.11 Combustion
.12 Associated systems & equipment
.13 Slow, medium and high speed
.14 Manoeuvring controls
.15 Protection devices

.16 Construction
.17 Timing
.18 Lubrication
.19 Alignment
.20 Automation
.21 Clutches
.22 Gear boxes
.23 Vibration dampers
.24 Thrust bearing
.25 Turbo chargers
.26 Diesel electric
.27 Diesel alternators
.28 Water treatment
.29 Survey

3. Steam Propulsion

.1 Operation
.2 Warming through
.3 Shutting down
.4 Manoeuvring
.5 Emergency
.6 Parameters
.7 Turbines
.8 Protection devices
.9 Thrust bearing
.10 Gland steam
.11 Flex coupling
.12 Manoeuvring V/V
.13 Automation
.14 Protection devices
.15 Lubrication
.16 Impulse, reaction
.17 Gear boxes
.18 Turbo electric
.19 Turbo alternators
.20 Operation and construction
.21 Associated systems & equipment
.22 Survey

4. Water Treatment

.1 Evaporators
.2 Distillers
.3 Ion exchange
.4 Reverse osmosis

.5 Testing
.6 Chemicals

5. Feed Systems

.1 Arrangement
.2 Feed pumps
.3 De-aerators and heaters
.4 Air ejector
.5 Ext pumps
.6 Condenser
.7 Water testing
.8 Auto controls

6. Steering Gear & Rudders

.1 Emergency operation
.2 Construction
.3 Control
.4 Lubrication
.5 Survey

7. Air Compressors

.1 Safety devices
.2 Compressor
.3 Receiver
.4 Air line
.5 Operation
.6 Lubrication
.7 Starting air
.8 Service and control air
.9 Receivers
.10 Automation
.11 Survey

8. Fire

.1 Prevention
.2 Extinction
.3 Hoses, extinguishers
.4 BA sets
.5 Procedures
.6 Fixed installations
.7 Detection
.8 Sensors, systems
.9 UMS requirements
.10 Structural fire protection

9. Pumping Systems

.1 Fire main
.2 Oily water separator
.3 Bunkering
.4 Bilge and ballast systems
.5 Salt water system
.6 Fresh water cooling
.7 Sewage plant
.8 Fuel oil system
.9 Diesel oil system
.10 Inert gas system
.11 Lubricating oil system
.12 Cargo system
.13 Sanitary system
.14 Purifiers, clarifiers
.15 Heaters
.16 Pumps: positive displacement, etc

10. Refrigeration Systems

.1 Safety
.2 Direct and indirect expansion
.3 Air conditioning
.4 Compressors

11. Materials

.1 Properties
.2 Destructive & non-destructive Testing

12. Propellers & Thrusters

.1 Fixed pitch
.2 Controllable pitch
.3 Operating system
.4 Stern tube bearing
.5 Screw shafts
.6 Cross thrusters
.7 Fixed and controllable pitch propeller
.8 Voith schneider, etc
.9 DP systems

13. Dry Docking

.1 Supply of fire fighting water
.2 Supply of electrical power
.4 Stability
.5 Ship structure
.6 Measurement of wear down, clearance

.7 Safety equipment
.8 Safety construction
.9 Load line

14. Tanks

.1 Safety precautions
.2 Entering
.3 Pressure testing
.4 Survey

15. Stability

.1 Free surface
.2 Damage control

16. Electricity

.1 Emergency generators
.2 Operation
.5 Testing
.6 Fault detection
.7 AC generators
.8 Operation
.9 Construction
.10 Control equipment
.11 Fault detection
.12 Protection devices
.13 DC generators
.14 AC generators
.15 Distribution
.16 Isolation
.17 Electric shock
.18 Protection devices
.19 Fault detection
.20 Main switchboard
.21 Emergency switchboard
.22 Distribution boards
.23 Flame proof
.24 Drip proof
.25 Intrinsically safe
.26 Transformers
.27 Two wire
.28 Non-earthed and earthed neutral
.29 Motors
.30 DC series shunt compound
.31 AC: single and three phase

17. **Deck Machinery**

.1 Davits
.2 Winches
.3 Windlass
.4 Cranes
.5 Derricks
.6 Hatches
.7 Other

18. **Automation & Control**

.1 Bridge control
.2 UMS
.3 Fault detection
.4 Transfer from manual to auto
.5 Measuring devices
.6 Testing
.7 Calibration
.8 Survey

19. **Machinery Records**

.1 Oil record book
.2 Log books
.3 Trend recording
.4 Official records

20. **Maritime Law**

.1 MARPOL, SOLAS
.2 ISM Code
.3 Marine orders
.4 Other

21. **Management**

.1 Training of engine-room staff
.2 Management and organization of ER staff/dept

ANNEX (H)

SYLLABUS FOR WRITTEN EXAMINATION OF ELECTRO-TECHNICAL OFFICER CERTIFICATE OF COMPETENCY

(Workshop skills Training Course)

(Under STCW Convention, Regulation III/6)

FUNCTION 1: ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT THE OPERATIONAL LEVEL

SUBJECT: GENERAL ENGINEERING KNOWLEDGE (*Supporting Knowledge*)

1.1 **MONITOR THE OPERATION OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS**

- .1 Basic understanding of the operation of mechanical engineering systems
  - .1 Prime Movers, Including Main Propulsion Plant
    - .1 construction and operation of diesel engines, steam and gas turbines, steam boilers and ship electric propulsion motors
    - .2 main propulsion plant configuration and efficiency
    - .3 configuration and operation of engine room and ship piping systems
    - .4 operation of ship propellers and propulsors
  - .2 Engine Room Auxiliary Machinery
    - .1 construction and operation of pumps, compressors, blowers, fans, heat exchangers, cleaning machinery, and stern tubes sealing arrangements
  - .3 Steering Systems
    - .1 construction and operation of steering gears, rudder propellers, azipods and cycloid propulsors
  - .4 Cargo Handling Systems
    - .1 construction and operation of cargo handling machinery of general cargo ships, reefer containers, tankers, LNG carriers and chemical carriers
  - .5 Deck Machinery
    - .1 construction and operation of cargo winches, deck cranes, mooring winches, windlasses, hatch cowers and watertight doors
  - .6 Hotel Systems
    - .1 construction and operation of ship HVAC systems ,toilet systems, water supply and dosing systems

- .2 Basic knowledge of heat transmission, mechanics and hydromechanics
  - .1 Heat Transmission, Mechanics, Hydromechanics
    - .1 basic information concerning heat transmission: processes of heat transmission
    - .2 basic information concerning mechanics: scalar and vector quantities, graphical representation of force, resultants, moment of force, equilibrium
    - .3 basic information concerning hydromechanics: hydrostatics, hydromechanics and fluid flow

SUBJECT: MARINE ELECTRO TECHNOLOGY

.3 Electro-technology and electrical machines theory

.1 Basic concepts and laws

.1 definitions of: current, voltage resistance, capacitance, inductance, electrical power and energy

.2 name and converts units for respective quantities

.2 DC circuits

.1 Ohm's law

.2 Kirchhoff's laws

.3 Thevenin's theorem

.4 star-delta transformation

.3 AC circuits

.1 Differences between AC and DC

.2 r.m.s. value of alternate current

.3 sinusoidal quantities by vectors

.4 phasor diagram for RL, RC and RLC circuits

.5 series and parallel RL, RC and RLC circuits

.6 resonance in series and parallel circuits

.7 phase and line voltages in three-phase systems

.8 active, reactive power, apparent power and power factor in single and three-phase AC circuits

.9 active, reactive power, apparent power and power factor in three-phase four-wire and three-wire systems

.10 nonsinusoidal voltage and current

.11 Fourier series for nonsinusoidal voltage and current representation

.12 phenomena in RL, RC and RLC circuits in transient states

.13 RL, RC and RLC circuits in transient states

.14 simple RL, RC and RLC circuits

.4 Magnetism and electromagnetic induction

.1 magnetic field on conductor carrying current

.2 Fleming's rule

.3 Faraday's law

.4 Lenz's law

.5 induced e.m.f

.6 coil inductance

.5 Fundamentals of electrical machines

.1 classification of electrical machines

.2 typical structures of various machines and used materials

.3 efficiency of electrical machines and characterizes the sources of energy losses

.4 proper cooling of the electrical machine

.5 electrical machines for marine applications and rules of their design

.6 marine applications of electrical machines

.6 DC machines

.1 principles and properties of DC motors and generators

.2 function of: the armature, the commutator, brushes and springs, field poles, field coils

.3 shunt series and compound DC motors

.7 Transformers
.1 single and three-phase transformers
.2 circuit and phazor diagram of transformer
.3 three-phase transformers
.4 voltage magnitude and frequency on operation of transformers
.5 operation of two transformers in parallel
.8 Asynchronous machines
.1 principles of asynchronous machines
.2 circuit and phazor diagram of asynchronous motor
.3 rotor, field winding, fan, terminals, windings connection
.4 current and load, from no load to full load
.5 synchronous speed and slip
.6 AC motors start-up and speed control
.7 double squirrel-cage and deep slot motors
.8 supply voltage and frequency variation on operation of asynchronous motors
.9 Synchronous machines
.1 structures and operating principles of synchronous machines
.2 properties of synchronous generator
.3 armature reaction
.4 circuit and phazor diagram of synchronous generator
.5 synchronous machine as motor and pf compensator
.6 properties of cylindrical and salient pole machines
.10 Special machines
.1 construction and operating principle of: of AC commutator motors, AC single phase motors, reluctance and permanent magnet machines

.4 Electrical power distribution boards and electrical equipment
.1 Power distribution boards
.1 transmission and distribution of electrical power
.2 exemplary single line distribution chart
.3 structural parts of power distribution system
.4 structural parts of power distribution system(feeder lines, branch circuits, distribution boards, switchgear boards and tie-breaker boards)
.5 structure of electrical switchboards
.6 protective devices selectivity
.2 Electrical Devices for Power Distribution
.1 power and insulation monitoring devices
.2 automatic circuit breakers and contacts, arc extinguishing methods
.3 purpose of lightning arrestors
.4 purpose of voltage transformers and current transformers
.5 principles of voltage transformers and current transformers and its characteristics
.6 secondary loop of current transformer and secondary side winding
.7 characteristics of fuses and automatic circuit breakers
.8 fuses and overload relays
.9 automatic circuit breaker
.10 purpose of insulation monitoring devices
.11 leakage current to time characteristics

.3 Cables
.1 marine cables and wires
.2 cable marks and identification system
.3 cables long-period current tolerance and acceptable voltage drop
.4 cable type
.5 voltage drop in particular electrical circuit
.6 basic rules of cable arrangement
.7 rules and purposes of cable shielding
.4 Other marine electrical devices
.1 types of marine rechargeable batteries
.2 proper charging current
.3 batteries maintenance procedure
.4 operating principles of fluorescent lamp
.5 stroboscopic phenomenon
.6 incandescent lamps and halogen lamps
.7 vapour lamps
.8 mercury-vapour lamps and sodium-vapour lamps
.9 Impressed Current Cathodic Protection
.10 UPS
.5 Fundamentals of automation, automatic control systems and technology
.1 Automation, Automatic Control Systems And Technology
.1 control systems,
.2 methods of control systems
.3 typical elements of control: P, I and D
.4 digital and analog controllers
.5 principles and structures in the process control
.6 various sensors
.7 actuators used in process control
.8 principles and control functions of single controlled objects, groups of objects and hierarchical structures
.9 principles of industrial sequence control
.10 principles of PLC Control Systems
.11 maintenance of PC and PLC on board
.6 Instrumentation, alarm and monitoring systems
.1 Instrumentation, Alarm and Monitoring Systems
.1 construction and properties of sensors, widely used in IAMCS systems: Pt-100, thermocouple, thermistor, strain gauge
.2 principle of two wires current standard
.3 fire detection systems
.4 monitoring methods of explosive conditions in engine crankcase
.5 principle of operation of photoelectric oil detection systems
.6 oxygen and other gases detection systems
.7 Electrical drives
.1 A.C. Motors
.1 three-phase induction motors
.2 types of motor
.3 three-phase induction motor
.4 cooling for flameproof motor
.5 speed and load, current and load, from no load to full load
.6 motor name plate
.7 driving torque in an induction motor

.8 slip
.9 variation of current of induction motor
.10 means of reduced-voltage starting
.11 direct on-line starter
.12 starting up induction motor with stator windings
.13 automatic star-delta starter
.14 continue running in its starting (star-connected) stage
.15 autotransformer starter
.16 reason of motor protection
.17 common over current relays
.18 overload current and a fault current
.19 trip, delays and overload
.20 fuses
.21 thermal relay
.22 single phasing and effect motor
.23 phase open-circuit
.24 under voltage trips
.25 single fixed speed, two or three fixed speeds infinitely variable speed
.26 stepped speeds
.27 variable speed
.28 Ward-Leonard
.29 variable-frequency motor

.2 D.C. Motors
.1 back E.M.F. (E_b) of a motor
.2 back E.M.F. and voltage drop in armature
.3 starting current and load current
.4 DC motor starter
.5 rotational speed *(N)*
.6 voltage and strength of the magnetic field for rotational speed
.7 shunt and series motors
.8 compound motors, long shunt and short shunt

.8 Technology of electrical materials
.1 Conductivity
.1 conductors, semiconductors and insulators
.2 conductivity

.2 Conductors
.1 single conductor
.2 temperature coefficient of resistivity
.3 properties of copper
.4 materials for conductors, resistors and electric contacts

.3 Semiconductors
.1 properties of semiconductors
.2 common semiconductors
.3 properties of varistors and thermistors
applications of thermistors

.9 Electro-Hydraulic and Electro-Pneumatic Systems
.1 Electro-Hydraulic and Electro-Pneumatic Systems
.1 principles of hydraulic and pneumatic drives
.2 construction and operation of hydraulic systems components
.3 construction and operation of pneumatic systems components

.10 Appreciations of the hazards and precautions required for the operation of power systems above 1,000 volts

.1 Hazards and Precautions Required for the Operation of Power Systems Above 1,000 Volts

.1 shock voltage and shock current

.2 distance electrical shock

.3 shock by the electrostatic charge

.4 influence of shock current on human body

.5 difference of electric shock

.6 meaning of warning signs

.7 essential lengthening and migration of electric arc at the voltages above 1 kV

.8 parameters of electric arc

1.2 MONITOR THE OPERATION OF AUTOMATIC CONTROL SYSTEMS OF PROPULSION AND AUXILIARY MACHINERY

.1 Preparation of control systems of propulsion and auxiliary machinery for operation

.1 Propulsion control systems

.1 functions and tasks of control systems

.2 block diagrams of main propulsion control systems

.3 safety systems of main propulsion

.4 speed control and reversing systems

.5 procedures for preparations to start and stopping of main engine

.2 Auxiliary machinery control systems

.1 automatic control systems air compressors

.2 automatic control systems of auxiliary boilers; steering gear; fuel oil, cooling and lubricating oil systems

.3 automatic control systems of fuel temperature and viscosity control for boiler starting and stopping procedures

.4 automatic control systems of FO and LO purifiers

.5 cut-in arrangements for auxiliary of unmanned machinery space

.6 automatic control systems of provision and cargo refrigeration plant

.7 automatic control systems of air conditioning plant

1.3 OPERATE GENERATORS AND DISTRIBUTION SYSTEMS

.1 Coupling, load sharing and changing over generators

.1 Coupling, Load Sharing And Changing Over Generators

.1 methods of synchronization

.2 generator voltage and frequency control systems

.3 control systems for distribution of active and reactive power of the generators

.4 power factor

.5 excitation systems of generators

.6 safety systems of generators

.7 parameters and limits of the generator and diesel engine protections

.8 emergency generator and starting methods

.2 Coupling and Breaking Connection Between Switchboards and Distribution Panels
.1 Coupling and Breaking Connection Between Switchboards and Distribution Panels
.1 generation and distribution of electrical energy
.2 construction, equipment and the service of main switchboard
.3 construction, equipment and service of emergency switchboard and distribution panels
.4 construction and operation principle of measuring instruments used in main and emergency switchboards
.5 circuit breakers and their tripping devices
.6 procedures for restarting ship equipment, after power supply failure (black-out)
.7 connection between main and emergency switchboards and safeguards
.8 equipment typically supplied from emergency switchboard
.9 procedure for change-over to shore-connection supply

1.4 OPERATE AND MAINTAIN POWER SYSTEMS IN EXCESS OF 1,000 VOLTS

.1 High Voltage Technology
.1 High Voltage Technology
.1 nature and forming of electric stresses
.2 high voltage insulation systems
.3 overvoltage characteristics
.4 ageing of electrical insulation
.5 development of high voltage power systems
.6 construction and operation of HV equipment
.7 types of circuit breakers
.8 electrical machines: motors, generators, transformers
.9 overvoltage protection, protectors and arresters
.2 Safety Precautions and Technology
.1 Safety Precautions and Technology
.1 general HV protection
.2 usage of portable HV measurement
.3 Safe Operation and Maintenance of High-Voltage Systems
.1 Safe Operation and Maintenance of High-Voltage Systems
.1 HV personal protection equipment (PPE)
.2 certification of personal protection equipment
.3 HV safety procedures

1.5 OPERATE COMPUTERS AND COMPUTERNETWORKS ON SHIPS

.1 Main Features of Data Processing
.1 Main Features of Data Processing
.1 data description methods in digital systems
.2 computer or PLC work memory structure
.3 specifies memory areas and memory addresses
.4 methods of memory access
.5 bit - data processing and logical functions

.6 Boolean Algebra for logic circuits
.7 byte and word data processing
.8 "For...next" and "if... else" operations
.9 data storage principles and methods
.10 PLC and PC program structures
.11 logic functions, output functions and block diagrams of system functions
.12 sequential systems and transition functions
.13 sequential control system
.14 digital PID Control method
.15 data smoothing methods and smoothing factor

.2 Construction and use of Computer Networks on ships
.1 Construction and use of Computer Networks on ships
.1 industrial networks in process control
.2 OSI/ISO Model
.3 basic binary codes in data exchange
.4 serial transmission data busses
.5 Internet and Ethernet protocols
.6 medium access methods
.7 Profibus DP network
.8 Industrial Ethernet network
.9 USS network
.10 Modbus network

1.6 USE ENGLISH IN WRITTEN AND ORAL FORM

.1 English Language
.1 usage of English in written and oral form
.2 English Language for Marine Engineers
.1 Usage of English in written and oral form

1.7 USE INTERNAL COMMUNICATION SYSTEMS

.1 Operation of all internal communication sytems on board
.1 Automatic Telephone System
.1 Automatic Telephone System on board modern ship
.2 Emergency Sound Powered Telephone System
.1 Sound Powered Telephones
.2 operation of Sound Powered Telephone and Automatic Telephone System
.3 Talkback - Intercom System
.1 Talkback Systems
.4 Public Address System (PA)
.1 operation and main components of PA System
.5 UHF communication system
.1 marine UHF radio communication

FUNCTION 2: MAINTENANCE AND REPAIR AT THE OPERATIONAL LEVEL
SUBJECT: MAINTENANCE AND REPAIR

2.1 **MAINTENANCE AND REPAIR OF ELECTRICAL AND ELECTRONIC EQUIPMENT**

.1 Safety Requirements for Working on Shipboard Electrical Equipment
- .1 Safety Requirements for Working on Shipboard Electrical Equipment
  - .1 safety hazards electrical equipment
  - .2 Personal Protective Equipment (PPE)
  - .3 overvoltage installation categories (IEC 1010-1 Standard)
  - .4 safe electric meter for overvoltage categories
  - .5 Lockout - Tagout procedures
  - .6 Job Safety Analysis process (JSA)
  - .7 Work Permit System
  - .8 fixed and portable earthing devices
  - .9 safety precautions

.2 Maintenance and Repair of Electrical System Equipment, Switchboards, Electric Motors, Generator and DC Electrical Systems and Equipment
- .1 Maintenance and Repair of Electrical System Equipment, Switchboards, Electric Motors, Generator and DC Electrical Systems and Equipment
  - .1 major and periodic overhaul
  - .2 main switchboard equipment maintenance
  - .3 generators maintenance
  - .4 AC and DC electric motors maintenance
  - .5 batteries maintenance

.3 Detection of Electric Malfunction, Location of Faults and Measures to Prevent Damage
- .1 Detection of Electric Malfunction, Location of Faults and Measures to Prevent Damage
  - .1 methods for detection of electrical failures
  - .2 electrical wiring diagrams
  - .3 earth fault and insulation testing instruments
  - .4 fault protection
  - .5 measurement before and after the running
  - .6 measurement after damage
  - .7 interpretation of measurement results

.4 Construction and Operation of Electrical Testing and Measuring Equipment
- .1 Construction and Operation of Electrical Testing and Measuring Equipment
  - .1 construction and operation principle of analogue and digital instruments
  - .2 rules for using and connection to the electrical circuit
  - .3 oscilloscope results
  - .4 insulation tester, fixed and portable

.5 The interpretation of electrical and electronic diagrams
- .1 Graphic symbols
  - .1 symbols of electric generators, motors, transformers
  - .2 symbols of electrical apparatus
  - .3 symbols of measurement sensors and electric measuring devices
  - .4 symbols of lighting fixtures
  - .5 symbols of electronic elements (diodes, bipolar transistors, thyristors (SCRs), GTOs, TRIACs, MOSFETs, IGBTs, IGCTs)

.2 Diagrams
.1 differences electrical diagrams
.3 Technical documentation
.1 contents of shipyard technical documentation
.2 operating manuals of ship equipment
.4 Interpretation of diagrams
.1 various types of diagrams

2.2 MAINTENANCE AND REPAIR OF AUTOMATION AND CONTROL SYSTEMS OF MAIN PROPULSION AND AUXILIARY MACHINERY

.1 Maintenance and Repair of Automation and Control Systems of Main Propulsion and Auxiliary Machinery
.1 Maintenance and Repair of Automation and Control Systems of Main Propulsion and Auxiliary Machinery
.1 maintenance of electrical, mechanical, pneumatic, hydraulic components and automation equipment of main propulsion and auxiliary machinery
.2 PID controllers maintenance
.3 actuators maintenance
.4 fuel temperature and viscosity automatic control system
.5 compressed air automatic control system
.6 maintenance of lubrication, fuel and cooling automatic control systems
.7 maintenance of steam production automatic control system
.8 maintenance of ship refrigeration plants control systems
.9 maintenance of auxiliary equipments control systems
.10 maintenance of steering gear control system

2.3 MAINTENANCE AND REPAIR OF BRIDGE NAVIGATION EQUIPMENT AND SHIP COMMUNICATION SYSTEMS

.1 Maintenance and repair of bridge navigation equipment
.1 Basics of Navigation
.1 definition of navigation
.2 basic navigational terms
.3 various types of navigation charts
.4 various types of navigation
.2 Radars
.1 radar principle of operation
.2 radars components and function
.3 Global Navigation Satellite Systems
.1 Global Navigation Satellite Systems
.2 DGPS system
.4 Ship Compass Equipment
.1 ship compass
.2 gyrocompass maintenance
.5 Speed Logs
.1 various speed logs
.6 Echo sounder Systems
.1 operation and maintenance of echo sounder system
.7 Marine Autopilots
.1 autopilot

.8 Voyage Data Recorders, Navigation Lights, Search Lights, Ship Horns and Sound Signal Systems, Wind Trackers

.1 Voyage Data Recorder

.2 Navigation Lights Control and Alarm System

.3 Search Lights and Remote Control System

.4 ship Horns and Sound Signal Control System\

.2 Maintenance and repair of ship communication systems

.1 Ship Communication Systems

.1 marine communication and electromagnetic waves

.2 receiving and transmitting lines of radio communication equipment

.3 various antenna types of marine communication

.4 GMDSS

.5 main and emergency power supply

.6 Inmarsat Satellite Communication System

.7 Automatic Identification System (AIS)

.8 Long Range Identification and Tracking System (LRIT)

.9 Ship Security Alert System (SSAS)

2.4 MAINTENANCE AND REPAIR OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS OF DECK MACHINERY AND CARGO-HANDLING EQUIPMENT

.1 Maintenance and repair of electrical, electronic and control systems of deck machinery

.1 Deck machinery

.1 electrical, electronic and control systems of deck machinery

.2 inspection and maintenance of deck machinery equipment

.2 Maintenance and repair of electrical, electronic and control systems of cargo handling equipment

.1 Deck cranes

.1 electrical, electronic and control systems of deck cranes

.2 routine inspection and maintenance of deck cranes equipment

.2 Reefer Containers

.1 routine inspection, maintenance and repair of reefer containers

.3 Cargo systems on tankers

.1 electrical, electronic and control systems of cargo systems on tankers

.2 inspection and maintenance of cargo systems on tankers

.3 Electrical and electronic systems operating in flammable areas

.1 Electrical and Electronic Systems Operating in Flammable Areas

.1 parameters of flammable substances

.2 type of protection of electrical equipment

.3 protection of non-electrical equipment

.4 rules of cabling running in hazardous area

.5 explosion proof equipment

.6 maintenance of electrical explosion-proof equipment

.4 Safety and emergency procedures

.1 Safety And Emergency Procedures

.1 safety and emergency procedures

.2 describes permission and co-ordination of work

.3 duties of Safety Electrician and assisting person assigned
.4 safety procedures
.5 exemplary dangerous job assigned

2.5 MAINTENANCE AND REPAIR OF CONTROL AND SAFETY SYSTEMS OF HOTEL EQUIPMENT

.1 Maintenance and repair of control and safety systems of hotel equipment
- .1 Elevators
  - .1 elevator working modes
  - .2 elevator safety devices
  - .3 maintenance procedures for main elevator components
- .2 Galley Equipment
  - .1 power supply circuits for galley equipment
  - .2 operation and maintenance of typical hot equipment
  - .3 operation and maintenance of typical cold equipment
- .3 Laundry equipment
  - .1 heavy duty washing machines
  - .2 tunnel washer system
  - .3 ironing and folding machines
- .4 Hotel safety and alarm systems
  - .1 advanced Fire Detection and Control System
  - .2 operation and maintenance of Hospital Call System
  - .3 operation and maintenance of cold room trap alarms
- .5 Hotel lighting systems
  - .1 advanced lighting systems
  - .2 methods of remote control of advanced lighting systems
  - .3 various types of lights

FUNCTION 3: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE OPERATIONAL LEVEL

SUBJECT: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD

3.1 ENSURE COMPLIANCE WITH POLLUTION

.1 The precautions to be taken to prevent pollution of the marine environment
- .1 International Convention for the Prevention of Pollution from Ships, 1973, and the Protocol of 1978 relating thereto (MARPOL 73/78)
  - .1 purpose of MARPOL 73/78
  - .2 port State authorities' inspections
  - .3 Annex I - Oil
  - .4 Annex II - Noxious Liquid Substances in Bulk
  - .5 Annex III - Harmful Substances Carried by Sea in Packaged Forms
  - .6 Annex IV – Sewage
  - .7 Annex V – Garbage
  - .8 Annex VI – Air

.2 Anti-pollution procedures and associated equipment
- .1 Basic knowledge of Regulation 26 Annex I MARPOL 73/78
  - .1 shipboard oil pollution emergency plan

.3 Importance of proactive measures
.1 Required performance
.1 proactive measures for marine environment
.2 pollution substances

3.2 **PREVENT CONTROL AND FIGHT FIRE ON BOARD**

.1 Fire prevention
.2 Organising fire drills
.3 Chemistry of fire
.4 Fire-fighting systems
.5 The action to be taken in the event of fire, including fires involving oil

3.3 **OPERATER LIFE-SAVING APPLIANCES**

.1 Organizing abandon ship drills and the operation of survival craft and rescue boats, their launching appliances and arrangements, their equipment, including radio-life-saving appliances, sattelite epirbs, sarts, immersion suits and thermal protective aids
.2 survival at sea techniques

3.4 **APPLY MEDICAL FIRST AID ON BOARD SHIP**

.1 Practical application of medical guides and advice by radio, the ability to take effective action based on such knowledge in the case of accidents or ilnesses that are likely to occur on board the ship

3.5 **CONTRIBUTE TO THE SAFETY OF PERSONNEL AND SHIP**

.1 Knowledge of personal survival techniques
.2 Knowledge of fire prevention and ability to fight STCW code and extinguish fires
.3 Knowledge of elementary first aid
.4 Knowledge of personal safety and social STCW code responsibilities

SYLLABUS FOR WRITTEN EXAMINATION OF ELECTRO-TECHNICAL OFFICER CERTIFICATE OF COMPETENCY

(*Preparatory Course*)

(Under STCW Convention, Regulation III/6)

FUNCTION 1: ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT THE OPERATIONAL LEVEL

SUBJECT: GENERAL ENGINEERING KNOWLEDGE (*SUPPORTING KNOWLEDGE)*

1.1 **MONITOR THE OPERATION OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS**

- .1 Basic understanding of the operation of mechanical engineering systems
  - .1 Prime Movers, Including Main Propulsion Plant
  - .2 Engine Room Auxiliary Machinery
  - .3 Steering Systems
    - .1 construction and operation of steering gears, rudder propellers, azipods and cycloid propulsors
  - .4 Cargo Handling Systems
    - .1 construction and operation of cargo handling machinery of general cargo ships, reefer containers, tankers, LNG carriers and chemical carriers
  - .5 Deck Machinery
    - .1 construction and operation of cargo winches, deck cranes, mooring winches, windlasses, hatch cowers and watertight doors
  - .6 Hotel Systems
    - .1 construction and operation of ship HVAC systems ,toilet systems, water supply and dosing systems

SUBJECT: MARINE ELECTRO TECHNOLOGY

- .2 Electro-technology and electrical machines theory
  - .1 AC circuits
    - .1 Differences between AC and DC
    - .2 r.m.s. value of alternate current
    - .3 sinusoidal quantities by vectors
    - .4 phasor diagram for RL, RC and RLC circuits
    - .5 series and parallel RL, RC and RLC circuits
    - .6 resonance in series and parallel circuits
    - .7 phase and line voltages in three-phase systems
    - .8 active, reactive power, apparent power and power factor in single and three-phase AC circuits
    - .9 active, reactive power, apparent power and power factor in three-phase four-wire and three-wire systems
    - .10 nonsinusoidal voltage and current
    - .11 Fourier series for nonsinusoidal voltage and current representation
    - .12 phenomena in RL, RC and RLC circuits in transient states
    - .13 RL, RC and RLC circuits in transient states
    - .14 simple RL, RC and RLC circuits

.2 Asynchronous machines
.1 AC motors start-up and speed control
.2 double squirrel-cage and deep slot motors
.3 supply voltage and frequency variation on operation of asynchronous motors
.3 Synchronous machines
.1 structures and operating principles of synchronous machines
.2 properties of synchronous generator
.3 armature reaction
.4 circuit and phazor diagram of synchronous generator
.5 synchronous machine as motor and pf compensator
.6 properties of cylindrical and salient pole machines
.4 Special machines
.1 construction and operating principle of: of AC commutator motors, AC single phase motors, reluctance and permanent magnet machines

.3 Fundamentals of electronics and power electronics
.1 Electronics and power electronics
.1 structure, principle, parameters and application of semiconductor elements: diodes, SCR, GTO and IGCT thyristors, field effect transistors - MOSFET and JFET, IGBT transistors
.2 power electronic converters
.3 of integrated stabilizers and operational amplifiers
.4 structure and operation of analog and impulse DC power supplies
.5 construction and operation of controlled rectifiers
.6 construction and operation of AC voltage controllers
.7 principle of operation and properties of MSI inverters
.8 principle of operation and properties of cycloconverters
.9 methods of assembly and replacement of semiconductor elements
.10 electronic and power electronic systems

.4 Electrical power distribution boards and electrical equipment
.1 Basic parameters, processes and environment influences
.1 marine environmental exposures for electrical devices
.2 typical technical parameters of electric devices
.3 process of electrical devices heating
.4 electrical arc and electrical arc protection devices
.5 short circuit and short circuit current
.6 short circuit tolerance of electrical devices

.5 Fundamentals of automation, automatic control systems and technology
.1 Automation, Automatic Control Systems And Technology
.1 control systems, digital and analog control circuits
.2 methods of control systems
.3 typical elements of control: P, I and D
.4 typical controllers: P, PI, PID
.5 digital and analog controllers
.6 principles and structures in the process control
.7 various sensors
.8 data processing in process control
.9 actuators used in process control

.10 digital control systems, Moore - automat and Mealy – automat
.11 principles and control functions of single controlled objects, groups of objects and hierarchical structures
.12 principles of industrial sequence control
.13 Programmable Logic Controllers and Programmable Automatic Controllers
.14 principles of PLC Control Systems
.15 modular and compact PLC devices
.16 reliability of computer control systems
.17 maintenance of PC and PLC on board

.6 Instrumentation, alarm and monitoring systems

.1 Instrumentation, Alarm and Monitoring Systems

.1 distributed monitoring systems for engine room
.2 individual PLC of distributed monitoring and control systems
.3 construction and properties of sensors, widely used in IAMCS systems: Pt-100, thermocouple, thermistor, strain gauge
.4 principle of two wires current standard
.5 methods of communication with smart transducers using HART protocol
.6 programmable transducers using Foundation Fieldbus or Profibus PA protocol
.7 construction of typical long distance analog measuring lines temperature
.8 construction of typical long distance digital (on-off) measuring lines
.9 construction of typical long distance digital (on-off) measuring lines with proximity switches
.10 construction of control line for control solenoids (on-off) and analog valves
.11 fire detection systems
.12 monitoring methods of explosive conditions in engine crankcase
.13 principle of operation of photoelectric oil detection systems
.14 oxygen and other gases detection systems

.7 Electrical drives

.1 A.C. Motors

.1 cooling for flameproof motor
.2 speed and load, current and load, from no load to full load
.3 driving torque in an induction motor
.4 slip
.5 variation of current of induction motor
.6 means of reduced-voltage starting
.7 automatic star-delta starter
.8 continue running in its starting (star-connected) stage
.9 autotransformer starter
.10 reason of motor protection
.11 common over current relays
.12 overload current and a fault current
.13 trip, delays and overload
.14 thermal relay
.15 single phasing and effect motor
.16 phase open-circuit

.17 under voltage trips
.18 single fixed speed, two or three fixed speeds infinitely variable speed
.19 stepped speeds
.20 variable speed
.21 Ward-Leonard
.22 variable-frequency motor

.2 D.C. Motors
.1 starting current and load current
.2 DC motor starter
.3 rotational speed *(N)*
.4 voltage and strength of the magnetic field for rotational speed

.8 Technology of electrical materials
.1 Conductors
.1 single conductor
.2 temperature coefficient of resistivity
.3 properties of copper
.4 materials for conductors, resistors and electric contacts

.2 Superconductors
.1 superconductor and general properties
.2 classification of superconducting materials
.3 superconductors

.3 Semiconductors
.1 properties of semiconductors
.2 common semiconductors
.3 properties of varistors and thermistors
.4 applications of thermistors

.4 Dielectric materials
.1 dielectric materials polarization
.2 dielectric constant
.3 origins of dielectric losses
.4 dielectric strength and insulation
.5 insulators properties
.6 ambient air temperature
.7 plastics and thermal properties
.8 cable insulation and sheath
.9 common dielectrics
.10 risk factors for insulating materials

.5 Magnetic materials
.1 magnetic material
.2 magnetic constant
.3 hysteresis loop, coercion field and residual magnetism
.4 Curie temperature
.5 soft and hard magnetic materials
.6 magnetic losses in materials
.7 decreasing losses in magnetic materials
.8 properties of magnetic steel with and without silicon doping
.9 properties of oriented and non-oriented steels
.10 common magnetic materials
.11 applications of various magnetic materials

.9 Electro-hydraulic and electro-pneumatic systems
.1 Electro-Hydraulic and Electro-Pneumatic Systems
.1 principles of hydraulic and pneumatic drives
.2 construction and operation of hydraulic systems components
.3 construction and operation of pneumatic systems components
.4 construction and operation of hydraulic systems control and operation
.5 marine hydraulic and pneumatic machinery
.10 Appreciations of the hazards and precautions required for the operation of power systems above 1,000 volts
.1 Hazards and precautions required for the operation of power systems above 1,000 volts
.1 shock voltage and shock current
.2 distance electrical shock
.3 shock by the electrostatic charge
.4 influence of shock current on human body
.5 difference of electric shock
.6 meaning of warning signs
.7 essential lengthening and migration of electric arc at the voltages above 1 kV
.8 parameters of electric arc

1.2 MONITOR THE OPERATION OF AUTOMATIC CONTROL SYSTEMS OF PROPULSION AND AUXILIARY MACHINERY

.1 Preparation of control systems of propulsion and auxiliary machinery for operation
.1 Propulsion control systems
.1 block diagrams of main propulsion control systems
.2 main propulsion control systems
.3 principle of propulsion control changeover in emergency
.4 safety systems of main propulsion
.5 electronic and electrical control systems
.6 speed control and reversing systems
.7 procedures for preparations to start and stopping of main engine
.2 Auxiliary machinery control systems
.1 automatic control systems and procedures for preparation and starting of air compressors
.2 automatic control systems of auxiliary boilers; steering gear; fuel oil, cooling and lubricating oil systems
.3 automatic control systems of fuel temperature and viscosity control for boiler starting and stopping procedures
.4 automatic control systems of FO and LO purifiers
.5 sequential re-starting for auxiliary machinery
.6 cut-in arrangements for auxiliary of unmanned machinery space
.7 automatic control systems of provision and cargo refrigeration plant
.8 automatic control systems of air conditioning plant

1.3 OPERATE GENERATORS AND DISTRIBUTION SYSTEMS

.1 Coupling, load sharing and changing over generators

.1 Coupling, Load Sharing And Changing Over Generators

.1 rules of parallel working of generators

.2 control systems for distribution of active and reactive power of the generators

.3 safety systems of generators

.4 parameters and limits of the generator and diesel engine protections

.5 methods of frequency and voltage stabilization of shaft generators

.6 principle of power management

.7 electrical energy balance

1.4 OPERATE AND MAINTAIN POWER SYSTEMS IN EXCESS OF 1,000 VOLTS

.1 High voltage technology

.1 High Voltage Technology

.1 nature and forming of electric stresses

.2 break-down strength of gases

.3 break-down strength of solid dielectrics and discharge mechanism in solids

.4 high voltage insulation systems

.5 overvoltage characteristics

.6 ageing of electrical insulation

.7 development of high voltage power systems

.8 construction and operation of HV equipment

.9 types of circuit breakers

.10 electrical machines: motors, generators, transformers

.11 overvoltage protection, protectors and arresters

.2 Safety precautions and technology

.1 Safety Precautions and Technology

.1 general HV protection

.2 usage of portable HV measurement

.3 Electrical propulsion of the ships, electrical motors and control systems

.1 Electrical Propulsion of the Ships, Electrical Motors and Control Systems

.1 advantages of ship electrical propulsion

.2 configurations of electrical propulsion

.3 block diagram of electrical propulsion system

.4 High Voltage Supply and Power range of electric propulsion systems

.5 main features of electric motors used in Main Propulsion systems

.6 propulsion supply equipment

.7 types of frequency drives used in main propulsion systems

.8 methods of electric motor control used in Propulsion Drives

.9 remote control system of podded propulsion

.4 Safe operation and maintenance of High-Voltage Systems

.1 Safe Operation and Maintenance of High-Voltage Systems

.1 HV personal protection equipment (PPE)

.2 certification of personal protection equipment

HV safety procedures

1.5 **OPERATE COMPUTERS AND COMPUTER NETWORKS ON SHIPS**

.1 Main features of data processing
- .1 data types and data description in digital system
- .2 computer of PLC work memory structure and access methods
- .3 bit. byte and World Data processing, logical functions, bit memory, time functions, counters, edges
- .4 typical computer programming instructions:
- .5 data storage, operation and stored values and addresses
- .6 PLC and PC program structures, combinational systems and sequential systems, functions and description of systems
- .7 digital PID control, data measurement and filtering

.2 Construction and use of computer networks on ships
- .1 Construction and use of computer networks on ships
  - .1 industrial networks in process control
  - .2 OSI/ISO Model
  - .3 basic binary codes in data exchange
  - .4 serial transmission data busses
  - .5 Internet and Ethernet protocols
  - .6 medium access methods
  - .7 Profibus DP network
  - .8 Industrial Ethernet network
  - .9 USS network
  - .10 Modbus network

.3 Bridge-Based, Engine-Room-Based and Commercial Computer Use
- .1 Bridge-Based, Engine-Room-Based and Commercial Computer Use
  - .1 Integrated Navigation Systems
  - .2 Voyage Data Recorder (VDR system)
  - .3 Dynamic Positioning System
  - .4 ship fuel consumption optimizing systems
  - .5 PLC or PC based power management systems
  - .6 PLC or PC based systems for fuel
  - .7 PLC or PC based refrigeration systems
  - .8 Electronic Alarm Recorder
  - .9 Computer Systems for critical equipment condition monitoring
  - .10 Load and Hull - Stress calculation systems

1.6 **USE ENGLISH IN WRITTEN AND ORAL FORM**

.1 English Language
- .1 usage of English in written and oral form
- .2 English Language for Marine Engineers
  - .1 Usage of English in written and oral form

1.7 **USE INTERNAL COMMUNICATION SYSTEMS**

.1 Operation of all internal communication systems on board
- .1 Automatic Telephone System
  - .1 Automatic Telephone System on board modern ship
  - .2 Automatic Telephone System (PBX, PABX, POTS, DECT, ISDN, VoIP)
  - .3 block diagrams of typical PBX
  - .4 PBX hardware modules and functions

.5 various functions of PBX
.6 PBX software maintenance and configuration
.7 hardware and software of DECT cordless phone system
.8 hardware, software and functions of Pager system

.2 Emergency Sound Powered Telephone System
.1 Sound Powered Telephones
.2 operation of Sound Powered Telephone and Automatic Telephone System
.3 design of Dynamic Microphones used in Sound Powered Telephones
.4 design and operation of calling circuit
.5 typical Sound Powered Telephone network on ship

.3 Talkback - Intercom System
.1 Talkback Systems
.2 operation of Talkback System

.4 Public Address System (PA)
.1 purpose of use PA systems
.2 operation and main components of PA System
.3 advanced PA system

.5 UHF communication system
.1 marine UHF radio communication
.2 operation of UHF repeaters
.3 UHF digital radio

FUNCTION 2: MAINTENANCE AND REPAIR AT THE OPERATIONAL LEVEL
SUBJECT: MAINTENANCE AND REPAIR

2.1 **MAINTENANCE AND REPAIR OF ELECTRICAL AND ELECTRONIC EQUIPMENT**

.1 Safety requirements for working on shipboard electrical equipment
.1 Safety requirements for working on shipboard electrical equipment
.1 safety hazards electrical equipment
.2 Personal Protective Equipment (PPE)
.3 overvoltage installation categories (IEC 1010-1 Standard)
.4 safe electric meter for overvoltage categories
.5 Lockout - Tagout procedures
.6 Job Safety Analysis process (JSA)
.7 Work Permit System
.8 fixed and portable earthing devices
.9 safety precautions

.2 Maintenance and Repair of Electrical System Equipment, Switchboards, Electric Motors, Generator and DC Electrical Systems and Equipment
.1 Maintenance and Repair of Electrical System Equipment, Switchboards, Electric Motors, Generator and DC Electrical Systems and Equipment
.1 major and periodic overhaul
.2 organization of maintenance
.3 maintenance intervals
.4 main switchboard equipment maintenance
.5 generators maintenance
.6 AC and DC electric motors maintenance

.7 batteries maintenance
.8 frequency converters, rectifiers and backup-UPS maintenance
.9 electronic tank content measuring systems maintenance
.10 electronic diagnostic systems maintenance

.3 Detection of Electric Malfunction, Location of Faults and Measures to Prevent Damage

.1 Detection of Electric Malfunction, Location of Faults and Measures to Prevent Damage

.1 methods for detection of electrical failures
.2 electrical wiring diagrams
.3 earth fault and insulation testing instruments
.4 fault protection
.5 measurement before and after the running
.6 measurement after damage
.7 interpretation of measurement results

.4 Construction and Operation of Electrical Testing and Measuring Equipment

.1 Construction and Operation of Electrical Testing and Measuring Equipment

.1 construction and operation principle of analogue and digital instruments
.2 rules for using and connection to the electrical circuit
.3 oscilloscope results
.4 insulation tester, fixed and portable

.5 Function, Configuration and Performance Tests of Monitoring Systems, Automatic Control Devices, Protective Devices

.1 Function, Configuration and Performance Tests of Monitoring Systems, Automatic Control Devices, Protective Devices

.1 type of monitoring system
.2 capacity and resistivity of long cables on measurement
.3 function of extension wires
.4 electronic reports
.5 smart transducer via HHC (hand held communicator- HART protocol)
.6 programming calibrator
.7 pressure calibrators
.8 4-20 mA calibrator
.9 fire detection systems

.6 The interpretation of electrical and electronic diagrams

.1 Graphic symbos

.1 symbols of measurement sensors and electric measuring devices
.2 symbols of electronic elements (diodes, bipolar transistors, thyristors (SCRs), GTOs, TRIACs, MOSFETs, IGBTs, IGCTs)

.2 Technical documentation

.1 contents of shipyard technical documentation
.2 operating manuals of ship equipment

.3 Interpretation of diagrams

.1 various types of diagrams

2.2 MAINTENANCE AND REPAIR OF AUTOMATION AND CONTROL SYSTEMS OF MAIN PROPULSION AND AUXILIARY MACHINERY

.1 Maintenance and repair of automation and control systems of main propulsion and auxiliary machinery

.1 Maintenance and repair of automation and control systems of main propulsion and auxiliary machinery

.1 maintenance of electrical, mechanical, pneumatic, hydraulic components and automation equipment of main propulsion and auxiliary machinery

.2 PID controllers maintenance

.3 actuators maintenance

.4 Ziegler-Nichols rule

.5 propulsion remote control systems maintenance

.6 maintenance of main propulsion

.7 fuel temperature and viscosity automatic control system

.8 maintenance of lubrication, fuel and cooling automatic control systems

.9 maintenance of variable pitch propeller control system

.10 maintenance of steam production automatic control system

.11 maintenance of ship refrigeration plants control systems

.12 maintenance of auxiliary equipments control systems

.13 maintenance of steering gear control system

2.3 MAINTENANCE AND REPAIR OF BRIDGE NAVIGATION EQUIPMENT AND SHIP COMMUNICATION SYSTEMS

.1 Maintenance and repair of bridge navigation equipment

.1 Radars

.1 radar principle of operation

.2 radars components and function

.3 bridge radar system

.4 radar diagnostic functions and troubleshooting

.5 radar performance monitoring

.6 radar magnetron assembly changing and tuning

.7 radar system maintenance

.8 Automatic Radar Plotting Aids (ARPA)

.2 Global Navigation Satellite Systems

.1 Global Navigation Satellite Systems

.2 operation of GLONASS, Galileo

.3 components of GPS system

.4 DGPS system

.5 GPS receiver and output signals

.3 Inertial Navigation System

.1 inertial navigation system

.4 Ship Compass Equipment

.1 ship compass

.2 gyro compass with spinning gyroscope

.3 gyrocompass maintenance

.4 Fiber Optic Gyrocompass (FOG) and Ring Laser Gyroscope (RLG)

.5 magnetic compass with remote repeater system

.5 Speed Logs

.1 various speed logs

.6 Echo sounder Systems
.1 operation and maintenance of echo sounder system
.7 Marine Autopilots
.1 features and operation of modern autopilot
.8 Voyage Data Recorders, Navigation Lights, Search Lights, Ship Horns and Sound Signal Systems, Wind Trackers
.1 maintenance of Voyage Data Recorder
.2 Navigation Lights Control and Alarm System
.3 Search Lights and Remote Control System
.4 ship Horns and Sound Signal Control System
.5 wind tracker and true wind repeaters

.2 Maintenance and repair of ship communication systems
.1 Ship Communication Systems
.1 marine communication and electromagnetic waves
.2 receiving and transmitting lines of radio communication equipment
.3 various antenna types of marine communication
.4 GMDSS
.5 Inmarsat Sat C, NBDB telex terminal with MF/HF transceiver, DSC, NAVTEX, EPIRB, SART
.6 main and emergency power supply
.7 of Inmarsat Satellite Communication System
.8 Iridium Satellite Telephone System
.9 Automatic Identification System (AIS)
.10 Long Range Identification and Tracking System (LRIT)
.11 Ship Security Alert System (SSAS)

2.4 MAINTENANCE AND REPAIR OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS OF DECK MACHINERY AND CARGO-HANDLING EQUIPMENT

.1 Maintenance and repair of electrical, electronic and control systems of deck machinery
.1 Deck machinery
.1 electrical, electronic and control systems of deck machinery
.2 inspection and maintenance of deck machinery equipment

.2 Maintenance and repair of electrical, electronic and control systems of cargo handling equipment
.1 Deck cranes
.1 electrical, electronic and control systems of deck cranes
.2 routine inspection and maintenance of deck cranes equipment
.2 Reefer Containers
.1 routine inspection, maintenance and repair of reefer containers
.3 Cargo systems on tankers
.1 electrical, electronic and control systems of cargo systems on tankers
.2 inspection and maintenance of cargo systems on tankers

.3 Electrical and Electronic Systems Operating in Flammable Areas
.1 Electrical and Electronic Systems Operating in Flammable Areas
.1 parameters of flammable substances
.2 type of protection of electrical equipment
.3 protection of non-electrical equipment
.4 rules of cabling running in hazardous area
.5 explosion proof equipment
.6 maintenance of electrical explosion-proof equipment
.7 Ex certificate

.4 Safety And Emergency Procedures
.1 Safety And Emergency Procedures
.1 safety and emergency procedures
.2 describes permission and co-ordination of work
.3 duties of Safety Electrician and assisting person assigned
.4 safety procedures
.5 exemplary dangerous job assigned

2.5 MAINTENANCE AND REPAIR OF CONTROL AND SAFETY SYSTEMS OF HOTEL EQUIPMENT

.1 Maintenance and Repair of Control and Safety Systems of Hotel Equipment
.1 Elevators
.1 ship elevator
.2 elevator working modes
.3 elevator safety devices
.4 maintenance procedures for main elevator components
.5 elevator diagnostic system
.6 operation and testing of elevator trap alarm or intercom
.2 Galley Equipment
.1 power supply circuits for galley equipment
.2 operation and maintenance of typical hot equipment
.3 operation and maintenance of typical cold equipment
.4 operation and maintenance of dishwashing machines
.3 Laundry equipment
.1 operation and maintenance of typical heavy duty washing machines
.2 operation and maintenance of tunnel washer system
.4 operation and maintenance of automatic ironing and folding machines
.4 Hotel safety and alarm systems
.1 advanced Fire Detection and Control System
.2 maintenance and diagnostics of advanced Fire Detection and Control System
.3 operation and maintenance of Hospital Call System
.4 operation and maintenance of cold room trap alarms
.5 Hotel lighting systems
.1 advanced lighting systems
.2 methods of remote control of advanced lighting systems
.3 various types of lights

FUNCTION 3: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE OPERATIONAL LEVEL

SUBJECT: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD

3.1 ENSURE COMPLIANCE WITH POLLUTION

.1 The precautions to be taken to prevent pollution of the marine environment
.1 International Convention for the Prevention of Pollution from Ships, 1973, and the Protocol of 1978 relating thereto (MARPOL 73/78)
.1 purpose of MARPOL 73/78
.2 violations of the Convention

.3 port State authorities' inspections
.4 violations and enforcement of the Convention
.5 reports on incidents
.6 Annex I – Oil
.1 provisions of the Convention
.2 conditions of oily mixtures discharging from an oil tanker
.3 condition of discharging oily mixtures from machinery
.7 Annex II - Noxious Liquid Substances in Bulk
.1 four categories of noxious liquid chemicals
.8 Annex III - Harmful Substances Carried by Sea in Packaged Forms
.1 harmful substances and hazardous to the marine environment
.9 Annex IV – Sewage
.1 provisions for discharge of sewage
.10 Annex V – Garbage
.1 Provision for Garbage disposal
.11 Annex VI – Air
.1 Provision for air pollution

.2 Anti-pollution procedures and associated equipment
.1 Basic knowledge of Regulation 26 Annex I MARPOL 73/78
.1 shipboard oil pollution emergency plan
.2 Basic knowledge of anti-pollution equipment required by national legislation
.1 equipment required under OPA 90

.3 Importance of proactive measures
.1 Required performance
.1 proactive measures for marine environment
.2 responsibilities of master, officer and rating
.3 impacts on marine environment
.4 pollution substances

3.2 **PREVENT CONTROL AND FIGHT FIRE ON BOARD**

.1 Fire prevention
.2 Organising fire drills
.3 Chemistry of fire
.4 Fire-fighting systems
.5 The action to be taken in the event of fire, including fires involving oil

3.3 **OPERATER LIFE-SAVING APPLIANCES**

.1 Organizing 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
.2 Survival at sea techniques

3.4 **APPLY MEDICAL FIRST AID ON BOARD SHIP**

.1 Practical application of medical guides and advice by radio, the ability to take effective action based on such knowledge in the case of accidents or ilnesses that are likely to occur on board the ship

3.5 APPLICATION OF LEADERSHIP AND TEAMWORKING SKILLS

.1 Introduction to Management
- .1 Introduction to Management
  - .1 term "Management"
  - .2 management activities
  - .3 roles of company's objectives and goals
  - .4 management policy
  - .5 managerial issues

.2 Related Conventions and National Legislation
- .1 Related Conventions and National Legislation
  - .1 Maritime Labour Convention, 2006 (MLC)
  - .2 conditions of employment, compliance and enforcement
  - .3 STCW Convention and Code

.3 Applies Task and Workload Management
- .1 Applies Task and Workload Management
  - .1 types of planning
  - .2 importance of planning
  - .3 activities in the planning process
  - .4 essential steps
  - .5 barriers to planning process
  - .6 techniques to overcome barriers
  - .7 Decision
  - .8 basic elements of organizational structure
  - .9 employee behaviours
  - .10 typical traits
  - .11 motivation and important in an organization
  - .12 "goal" and functions of goals
  - .13 attributes of goals

.4 Applies Effective Resource Management and Decision Making
- .1 Applies Effective Resource Management and Decision Making
  - .1 Communication
  - .2 functions of the communication
  - .3 process of communication
  - .4 failure of communication
  - .5 effectively communicate
  - .6 types of leaders
  - .7 types of leadership behaviours
  - .8 group development
  - .9 process of group meeting management
  - .10 organizational conflict
  - .11 techniques for preventing group conflicts
  - .12 ineffective in managing group conflicts
  - .13 stringent rules and regulations to resolve conflicts
  - .14 process and importance of control systems
  - .15 five stages of problem solving
  - .16 formal and personal authority
  - .17 importance of pre—planning
  - .18 situation and risk assessment
  - .19 delegation and benefits
  - .20 evaluation of outcomes effectiveness

3.6 **CONTRIBUTE TO THE SAFETY OF PERSONNEL AND SHIP**

.1 Knowledge of personal survival techniques

.2 Knowledge of fire prevention and ability to fight STCW Code and extinguish fires

.3 Knowledge of elementary first aid

.4 Knowledge of personal safety and social STCW Code responsibilities

SYLLABUS FOR ORAL EXAMINATION OF ELECTRO-TECHNICAL OFFICER CERTIFICATE OF COMPETENCY

(Under STCW Convention, Regulation III/6)

1 **ELECTRICAL, ELECTRONIC AND CONTROLL ENGINEERING**

1.1 **MONITOR THE OPERATION OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS**

.1 Basic understanding of the operation of mechanical engineering systems

.1 Prime Movers, Including Main Propulsion Plant

.1 types of diesel engine used for propulsion

.2 two stroke engine

.3 four stroke engine

.4 stroke engine major components and purpose

.5 constructions of steam turbines

.6 constructions of gas turbines

.7 boiler mountings

.8 electric propulsion motor operations

.9 main propulsion plant configuration and efficiency

.10 piping and cooling systems on board

.2 Engine Room Auxiliary Machinery

.1 types of pump used for ship operation

.2 Explain construction and operation of pump

.3 construction and operation of air compressor

.4 construction and operation of blower

.5 construction and operation of ventilation fans

.6 construction and operation of heat exchanger

.7 stern tubes seal

.3 Steering Systems

.1 construction and operation of steering gear

.2 types of rudder used for sea going ship

.3 construction and operation of propeller

.4 construction and operation of azipods and cycloid propulsion system

.4 Cargo Handling Systems

.1 for general cargo ships

.2 for reefer containers

.3 for cargo operation on tankers

.4 for cargo operation on LNG carriers and chemical carriers

.5 Deck Machinery

.1 Construction and operation of:

.1 cargo winches

.2 deck cranes

.3 mooring winches

.4 windlass

.5 hatch covers

.6 watertight doors

.6 Hotel Systems
.1 Construction and operation of ships':
.1 HVAC systems
.2 toilet systems
.3 water supply
.4 dosing systems

.2 Basic knowledge of heat transmission, mechanics and hydromechanics
.1 Heat Transmission, Mechanics, Hydromechanics
.1 processes of heat transmission
.2 scalar and vector quantities
.3 graphical representation of force
.4 resultants
.5 moment of force
.6 equilibrium
.7 hydrostatics, hydromechanics and fluid flow

.3 Electro-Technology and electrical machines theory
.1 Basic concepts and laws
.1 definition of current
.2 definition of voltage
.3 definition of resistance
.4 definition of capacitance
.5 definition of inductance
.6 definition of electrical power and energy
.2 DC circuits
.1 Ohm's law
.2 Kirchhoff's laws and uses the laws in solving electrical circuits
.3 Thevenin's theorem and uses the theorem in solving electrical circuits
.4 star-delta transformation
.3 AC circuits
.1 differences between AC and DC
.2 r.m.s. value of alternate current
.3 sinusoidal quantities by vectors
.4 phasor diagram for RL, RC and RLC circuits
.5 series and parallel RL, RC and RLC circuits
.6 resonance in series and parallel circuits
.7 relations between phase and line voltages in three-phase systems
.8 active, reactive power, apparent power and power factor
.9 methods of measurement of active, reactive power, apparent power and power factor in three-phase four-wire and three-wire systems
.10 non sinusoidal voltage and current
.11 Fourier series for non sinusoidal voltage and current
.12 RL, RC and RLC circuits in transient states
.4 Magnetism and electromagnetic induction
.1 magnetic field on conductor carrying current
.2 Fleming's rule
.3 Faraday's law
.4 Lenz's law
.5 self and mutually induced e.m.f
.6 coil inductance with and without iron core

.5 Fundamentals of electrical machines
- .1 the term "electrical machine"
- .2 classification of electrical machines
- .3 structures of various machines and used materials
- .4 efficiency concept of electrical machines and characterizes the sources of energy losses
- .5 cooling of the electrical machine
- .6 machines for marine applications and rules of their design, including high voltage machines (above 1 kV)
- .7 lists marine applications of electrical machines

.6 DC machines
- .1 operation principles and properties of DC motors and generators
- .2 function of the armature
- .3 commutator, brushes and springs
- .4 field poles and field coils
- .5 shunt, series and compound DC motors
- .6 DC motors start-up and speed control

.7 Transformers
- .1 structures and operating principles of single and three-phase transformers
- .2 equivalent circuit and phazor diagram of transformer
- .3 characteristic connection groups of three-phase transformers
- .4 variations of voltage magnitude and frequency on operation of transformers
- .5 operation of two transformers in parallel

.8 Asynchronous machines
- .1 structures and operating principles of asynchronous machines
- .2 equivalent circuit and phazor diagram of asynchronous motor
- .3 an arrangement of asynchronous motor, identifies rotor, field winding, fan, terminals, windings connection
- .4 relations between speed and load, current and load, and from no load to full load
- .5 motor structure, synchronous speed and the term of slip
- .6 AC motors start-up and speed control
- .7 double squirrel-cage and deep slot motors
- .8 name plate, meaning of all the information displayed
- .9 consequences of supply voltage and frequency variation on operation of asynchronous motors

.9 Synchronous machines
- .1 structures and operating principles of synchronous machines
- .2 properties of synchronous generator
- .3 armature reaction
- .4 equivalent circuit and phazor diagram of synchronous generator
- .5 work of synchronous machine as motor and pf compensator
- .6 properties of cylindrical and salient pole machines

.10 Special machines
- .1 Construction and operating principle of:
  - .1 AC commutator motors
  - .2 AC single phase motors
  - .3 reluctance and permanent magnet machines

.4 Fundamentals of electronics and power electronics

.1 Electronics and power electronics

.1 Operation parameters and application of:

.2 Classification of power electronic converters and areas of their application on ships:

.3 diagnostics, methods of assembly and replacement of semiconductor elements

.4 requirements for electronic and power electronic systems installed on ships

.5 Electrical power distribution boards and electrical equipment

.1 Basic parameters, processes and environment influences

.1 marine environmental exposures for electrical devices

.2 technical parameters of electric devices – in e.g.: nominal voltage, on-load voltage, test voltage, protection grade, nominal current, peak power, power factor, etc.

.3 electrical devices heating while: continues load, intermittent load, part-time load or short circuit load

.4 temperature dependence on working time

.5 electrical arc and electrical arc protection devices

.6 reasons and consequences of short circuit, describes short circuit current characteristics

.7 short circuit tolerance of electrical devices

.2 Power distribution boards

.1 transmission and distribution of electrical power

.2 single line distribution chart

.3 structural parts of power distribution system:

.4 feeder lines

.5 branch circuits

.6 distribution boards

.7 switchgear boards

.8 tie-breaker boards

.9 structure of electrical switchboards

.10 protective devices selectivity

.3 Electrical Devices for Power Distribution

.1 Describes following electrical devices used for power distribution:

.1 fuses

.2 automatic circuit breakers

.3 disconnect switches

.4 motor protection

.5 over current relays

.6 largest possible overload current and a fault current

.7 over current trip, time delays and fuses with both overload and fault currents

.8 selection of fuses

.9 thermal relay, including the means of its adjustment

.10 single phasing and its effect on a motor:

.11 protection against running with a phase open-circuit

.12 explains why under voltage trips are necessary
.13 states applications where the following speeds are suitable:
.14 provision of stepped speeds
.15 producing variable speed
.16 Ward-Leonard drive
.17 variable-frequency motor

.4 Cables
.1 cable marks and identification system
.2 the cross-section of cables considering long-period current
.3 tolerance and acceptable voltage drop
.4 basic rules of cable arrangement
.5 rules and purposes of cable shielding

.5 Other marine electrical devices
.1 marine rechargeable batteries
.2 charging current for particular battery
.3 batteries maintenance procedure
.4 incandescent lamps and halogen lamps
.5 vapour lamps
.6 mercury-vapour lamps and sodium-vapour lamps
.7 Impressed Current Cathodic Protection
.8 UPS

.6 Fundamentals of automation, automatic control systems and technology
.1 Automation, Automatic Control Systems and Technology
.1 structures of control systems, defines and characterizes digital and analog control circuits
.2 typical controllers: P, PI, PID
.3 characterizes digital and analog controllers
.4 Principles, structures and various sensors in the process control
.5 digital control systems
.6 single controlled objects, groups of objects and hierarchical structures
.7 industrial sequence control
.8 Programmable Logic Controllers
.9 Programmable Automatic Controllers
.10 structure and programming principles of PLC

.7 Instrumentation, alarm and monitoring systems
.1 Instrumentation, Alarm and Monitoring Systems
.1 monitoring systems for engine room and deck
.2 communication among individual PLC of distributed monitoring and control systems
.3 construction and properties of sensors, used in IAMCS systems
.4 explains principle of two wires current standard 4-20mA
.5 communication with smart transducers using HART protocol
.6 communication with programmable transducers using Foundation Fieldbus or Profibus PA protocol
.7 construction of typical long distance analog measuring lines for temperature

.8 construction of typical long distance digital (on-off) measuring lines
.9 construction of typical long distance digital (on-off) measuring lines with proximity switches
.10 construction of control line for control solenoids (on-off) and analog valves (4-20 mA)
.11 fire detection systems
.12 monitoring methods of explosive conditions in engine crankcase (oil mist detection systems for bearings' temperature measurement)
.13 operation of photoelectric oil detection systems

.8 Electrical drives
.1 A.C. Motors
.1 three-phase induction motors
.2 cooling
.3 relationship between speed and load, current and load, from no load to full load
.4 name plate, explains the meaning of the information displayed
.5 the driving torque and slip
.6 direct start of induction motor
.7 direct on-line starter
.8 star-connected
.9 star-delta starter,
.10 autotransformer starter
.11 over current relays
.12 overcurrent trip, time delays and fuses with both overload and fault currents
.13 thermal relay
.14 single phasing and its effect on a motor
.15 protections against phase open-circuit, undervoltage
.16 producing variable speed
.17 Ward-Leonard drive
.18 variable-frequency motor
.2 D.C. Motors
.1 back E.M.F. (E_b) of a motor
.2 DC motor starter
.3 typical applications
.4 compound motors
.9 Technology of electrical materials
.1 Conductivity
.1 conductivity of conductors, semiconductors and insulators
.2 factors which govern the variation of conductivity of various materials
.2 Conductors
.1 resistance of single conductors
.2 resistance of metal conductors
.3 properties of copper
.4 materials used as conductors, resistors and electric contacts
.3 Superconductors
.1 the term "superconductor"

.2 classification of superconducting materials
.3 applications of superconductors

.4 Semiconductors
.1 properties of semiconductors
.2 semiconductors
.3 properties of varistors and thermistors
.4 thermistors

.5 Dielectric materials
.1 dielectric materials polarization
.2 "dielectric constant"
.3 dielectric losses
.4 reasons of break-down of insulation
.5 influence of temperature on insulators properties
.6 maximum temperatures which common insulation material can withstand
.7 characteristic of plastics and their thermal properties
.8 materials for cable insulation and sheath
.9 dielectrics used on shipboard
.10 risk factors for insulating materials in marine environment

.6 Magnetic materials
.1 "magnetic material" and magnetic constant
.2 hysteresis loop
.3 Curie temperature
.4 "soft magnetic materials" and "hard magnetic materials"
.5 losses in magnetic materials
.6 magnetic steel, oriented and non-oriented steels
.7 magnetic materials

.10 Electro-hydraulic and electro-pneumatic systems
.1 Electro-Hydraulic and Electro-Pneumatic Systems
.1 principles of hydraulic and pneumatic drives
.2 construction and operation
.3 marine hydraulic and pneumatic machinery

.11 Appreciations of the hazards and precautions required for the operation of power systems above 1,000 volts
.1 Hazards and Precautions Required for the Operation of Power Systems Above 1,000 Volts
.1 shock voltage and shock current
.2 possibility of distance electrical shock
.3 possibility of the electrical shock by the electrostatic charge
.4 influence of shock current on human body
.5 electric shock caused by low and high voltage
.6 meaning of warning signs
.7 essential lengthening and migration of electric arc at the voltages above 1kV
.8 parameters of electric arc: the temperature, the energy etc.

1.2 **MONITOR THE OPERATION OF AUTOMATIC CONTROL SYSTEMS OF PROPULSION AND AUXILIARY MACHINERY**

.1 Preparation of control systems of propulsion and ` auxiliary machinery for operation

.1 Propulsion control systems

.1 the functions and tasks of control systems

.2 block diagrams of main propulsion control systems

.3 control systems used in normal conditions and in emergency

.4 safety systems of main propulsion

.5 control systems operating parameters of the main propulsion

.6 speed control and reversing systems of main engine

.7 procedures

.2 Auxiliary machinery control systems

.1 air compressors

.2 auxiliary boilers; steering gear; fuel oil, cooling and lubricating oil systems

.3 fuel temperature and viscosity control and explains boiler starting and stopping procedures

.4 FO and LO purifiers

.5 sequential re-starting for auxiliary machinery

.6 cut-in arrangements for auxiliary

.7 automatic control systems of cargo refrigeration plant

.8 air conditioning plant

1.3 **OPERATE GENERATORS AND DISTRIBUTION SYSTEMS**

.1 Coupling, load sharing and changing over generators

.1 Coupling, Load Sharing and Changing Over Generators

.1 rules of parallel working of generators

.2 methods of synchronization

.3 generator voltage and frequency control systems

.4 control systems for distribution of active and reactive power of the generators

.5 power factor

.6 excitation systems of generators

.7 safety systems of generators and their diesel engines

.8 generator and diesel engine protections

.2 Coupling and breaking connection between switchboards and distribution panels

.1 Coupling and Breaking Connection Between Switchboards and Distribution Panels

.1 generation and distribution of electrical energy on ships

.2 construction, equipment and the service

.3 construction and operation principle of measuring instruments used in main and emergency switchboards and distribution panels with specific reference to: voltmeter, ammeter, wattmeter, frequency meter, synchroscope, power factor meter and earth fault meter

.4 construction and operation principle of circuit breakers and their tripping devices

.5 procedures for restarting ship equipment, after power supply failure (black-out) on board
.6 connection between main and emergency switchboards
.7 equipment typically supplied from emergency switchboard
.8 procedure for change-over to shore-connection supply

1.4 OPERATE AND MAINTAIN POWER SYSTEMS IN EXCESS OF 1,000 VOLTS

.1 High voltage technology
.1 High Voltage Technology
.1 electric stresses
.2 break-down strength
.3 overvoltage characteristics, short-circuit and weak reactive current switching overvoltage
.4 ageing of electrical insulation
.5 circumstances causing development of high voltage power systems on ships
.6 construction and operation of HV equipment
.7 overvoltage protection, protectors and arresters, insulation systems coordination, voltage disturbances and threats elimination

.2 Safety precautions and technology
.1 Safety Precautions and Technology
.1 general HV protection measures: housings, partitions, distances, insulation mats, insulation materials, access restrictions, markings and warnings, HV equipment access monitoring and locks
.2 fixed and portable HV measurement and control apparatus for testing insulation resistance of HV machines, cables and another equipment,
.3 use HV testers

.3 Electrical propulsion of the ships, electrical motors and control systems
.1 Electrical Propulsion of the Ships, Electrical Motors and Control Systems
.1 ship electrical propulsion
.2 electrical propulsion
.3 diagram of electrical propulsion system with all main components
.4 High Voltage Supply and Power range of electric propulsion systems
.5 electric motors used in Main Propulsion systems: types, construction, excitation and cooling
.6 propulsion supply equipment: transformers, slip rings
.7 frequency drives used in main propulsion systems: Frequency Converter, Cyclo converter
.8 electric motor control used in Propulsion Drives: vector control, direct torque control
.9 remote control system of podded propulsion

.4 SAFE OPERATION AND MAINTENANCE OF HIGH-VOLTAGE
.1 Safe Operation and Maintenance of High-Voltage Systems
.1 HV personal protection equipment (PPE)
.2 certification of personal protection equipment
.3 HV safety procedures

1.5 OPERATE COMPUTERS AND COMPUTER NETWORKS ON SHIPS

.1 Main features of data processing

.1 Main Features of Data Processing

.1 data description methods in digital systems
.2 PLC work memory structure
.3 memory addresses
.4 memory access
.5 data processing
.6 Boolean Algebra
.7 byte and word data processing
.8 "For…next" and "if… else" operations
.9 data storage principles and methods
.10 PLC and PC program structures
.11 combinatorial systems,
.12 sequential systems,
.13 sequential control system in digital PID Control method
.14 filtering of measurement data

.2 Construction and use of computer networks on ships

.1 Construction and Use of Computer Networks on Ships

.1 industrial networks
.2 OSI/ISO Model
.3 basic binary codes in data exchange
.4 transmission data busses, characterizes RS 232, RS 422, RS 485
.5 Internet and Ethernet protocols: OSI/ISO, TCP/IP
.6 medium access methods: master-slave, master-slave with cyclical polling, token ring, token ring with master-slave polling, CSMA/CD, CSMA/CA
.7 Profibus DP network, characterizes nodes, structures, objects of configuration, programming of data exchange
.8 Industrial Ethernet network, characterizes nodes, structures, configuration, data exchange configured objects: connections, transfers, calls the instructions, principles of data exchange programming
.9 USS network, characterizes nodes, structures, configuration, data exchange
.10 Modbus network, describes the nodes, structures, configured objects

.3 Bridge-based, engine-room-based and commercial computer use

.1 Bridge-Based, Engine-Room-Based and Commercial Computer Use

.1 Integrated Navigation Systems
.2 Voyage Data Recorder (VDR system)
.3 Dynamic Positioning System
.4 ship fuel consumption optimizing systems (e.g. NAPA, ENIRAM)
.5 PLC or PC based
.6 Electronic Alarm Recorder (e.g. Prilog)
.7 critical equipment conditions monitoring (for example METALSCAN, SWANTECH)
.8 Load and Hull - Stress calculation systems

1.6 **USE INTERNAL COMMUNICATION SYSTEMS**

.1 Operation of all internal communication systems on board

.1 Automatic Telephone System

.1 various terms of PBX, PABX, POTS, DECT, ISDN, VoIP

.2 typical PBX

.3 PBX hardware modules

.4 various functions of PBX

.5 PBX software maintenance

.6 hardware and software of DECT cordless phone system

.7 hardware, software and functions of Pager system

.2 Emergency Sound Powered Telephone System

.1 principle and design of Dynamic Microphones used in Sound Powered Telephones

.2 design and operation of calling circuit

.3 Sound Powered Telephone network

.3 Talk Back System

.1 Talkback network on ship

.4 Public Address System

.1 main components of PA System

.2 advanced PA system

.5 UHF internal communication system

.1 marine UHF radio communication

.2 programming UHF digital radio set used with repeater system

2 **MAINTENANCE AND REPAIR**

2.1 **MAINTENANCE OF REPAIR OF ELECTRICAL AND ELECTRONIC EQUIPMENT**

.1 Safety requirements for working on shipboard electrical equipment

.1 Safety Requirements for Working on Shipboard Electrical Equipment

.1 hazards

.2 Personal Protective Equipment (PPE)

.3 overvoltage installation

.4 choose safe electric meter

.5 Lockout

.6 Job Safety Analysis process

.7 Work Permit System works

.8 fixed and portable earthing devices

.9 safety precautions when performing various maintenance or repair tasks

.2 Maintenance and repair of electrical system equipment, switchboards, electric motors, generators and dc electrical systems and equipment

.1 Maintenance and Repair of Electrical System Equipment, Switchboards, Electric Motors, Generator and DC Electrical Systems and Equipment

.1 major and periodic overhaul, periodic and daily maintenance, survey

.2 document maintenance, repairs and trials

.3 intervals, repairs and spare parts in the computer system (e.g. AMOS)

.4 equipment installed in main switchboard, emergency switchboard and distribution panels
.5 generators with specific reference
.6 AC and DC electric motors with specific reference
.7 batteries of different types
.8 frequency converters, rectifiers and backup-UPS
.9 electronic tank content measuring systems
.10 electronic diagnostic systems for testing diesel engine

.3 Detection of electric malfunction, location of faults and measures to prevent damage
.1 Detection of Electric Malfunction, Location of Faults and Measures to Prevent Damage
.1 methods for detection of electrical failures
.2 find fault using electrical wiring diagrams
.3 logical procedure to detect the location of an earth fault
.4 take measurement before and after the running of the device
.5 take measurement after damage and repair
.6 interpretation of measurement results

.4 Construction and operation of electrical testing and measuring equipment
.1 Construction and Operation of Electrical Testing and Measuring Equipment
.1 principle of analogue and digital instruments
.2 basic rules for using and connection of instruments to the electrical circuit
.3 interprets the results from oscilloscope
.4 insulation tester, fixed and portable

.5 Function, configuration and performance tests of monitoring systems, automatic control devices, protective devices
.1 Function, Configuration and Performance Tests of Monitoring Systems, Automatic Control Devices, Protective Devices
.1 simulators or calibrators to the terminals of PLC or other type of monitoring system
.2 influence of capacity and resistivity of long cables
.3 extension wires in the temperature measurement line
.4 electronic reports following computer maintenance programs
.5 smart transducer as calibrator by programming via HHC (hand held communicator- HART protocol)
.6 pressure calibrators
.7 4-20 mA calibrator
.8 maintenance of fire detection systems

.6 The interpretation of electrical and electronic diagrams
.1 Graphic symbols
.1 symbols of electric generators, motors, transformers
.2 symbols of electrical apparatus: contacts, switches, breakers, relays, time-delay relays, thermal relays, contactors, signal lights, fuses
.3 symbols of measurement sensors and electric measuring devices
.4 symbols of lighting fixtures, switches, sockets, connection boxes,
.5 symbols of electronic elements: diodes, bipolar transistors, thyristors (SCRs), GTOs, TRIACs, MOSFETs, IGBTs, IGCTs

.2 Diagrams
  .1 basic differences between the following electrical diagrams
.3 Technical documentation
  .1 shipyard technical documentation
  .2 operating manuals of ship equipment
.4 Interpretation of diagrams
  .1 interprets of various diagrams

2.2 MAINTENANCE AND REPAIR OF AUTOMATION AND CONTROL SYSTEMS OF MAIN PROPULSION AND AUXILIARY MACHINERY

.1 Maintenance and repair of automation and control systems of main propulsion and auxiliary machinery
  .1 Maintenance and Repair of Automation and Control Systems of Main Propulsion and Auxiliary Machinery
    .1 principles of maintenance and repair
    .2 controller optimal settings
    .3 propulsion remote control systems
    .4 main propulsion with specific reference
    .5 fuel temperature and viscosity automatic control system
    .6 compressed air automatic control system
    .7 lubrication, fuel and cooling automatic control systems
    .8 variable pitch propeller control system
    .9 steam production automatic control system
    .10 refrigeration plants control systems: provision, refrigerated cargo holds and containers, air condition
    .11 engine auxiliary control systems: oil and fuel separators, sewage treatment plant, evaporator and osmotic fresh water generators, incinerators
    .12 steering gear control system

2.3 MAINTENANCE AND REPAIR OF BRIDGE NAVIGATION EQUIPMENT AND SHIP COMMUNICATION SYSTEMS

.1 Maintenance and repair of bridge navigation equipment
  .1 Basics of Navigation
    .1 basic navigational terms and their measuring units
    .2 navigation charts, basic information they contain and their various types: paper charts, electronic charts (Raster, ECDIS)
    .3 various types of navigation: terrestrial (Dead Reckoning), celestial, radar, radio, satellite, inertial
  .2 Radars
    .1 principle of operation
    .2 main components
    .3 block diagram of bridge radar system with interswitch
    .4 diagnostic functions and troubleshooting documentation
    .5 performance monitor works
    .6 magnetron assembly and tune the radar in after the repair
    .7 periodic maintenance jobs
    .8 Automatic Radar Plotting Aids (ARPA)

.3 Global Navigation Satellite Systems
  .1 operation of Global Navigation Satellite Systems: GPS, GLONASS, Galileo
  .2 main components of GPS
  .3 operation of DGPS system
  .4 GPS receiver is interfaced with other navigation equipment
.4 Inertial Navigation System
  1 operation of inertial navigation system
.5 Ship Compass Equipment
  .1 basic knowledge of operation, maintenance and repairs of ship compass equipment:
    .1 main components of gyro compass with spinning gyroscope
    .2 synchronization process and deviations of gyrocompass
    .3 periodic maintenance work required for gyrocompass with spinning gyroscope and other moving parts
    .4 main components of Fiber Optic Gyrocompass (FOG) and Ring Laser Gyroscope (RLG)
    .5 gyrocompass is interfaced to other navigation equipment
    .6 main components of magnetic compass with remote repeater system
.6 Speed Logs
  .1 construction, operation, maintenance and troubleshooting
  .2 Doppler Log System
  .3 Electromagnetic Log System
  .4 Pitometer Log System
.7 Echosounder Systems
  .1 construction, operation, configuration, maintenance and troubleshooting of echosounder system
.8 Marine Autopilots
  .1 principle of operation
  .2 various modes of operation
  .3 modern autopilot and its features
.9 Voyage Data Recorders, Navigation Lights, Search Lights, Ship Horns and Sound Signal Systems, Wind Trackers
  .1 operation and periodic maintenance of Voyage Data Recorder
  .2 operation, maintenance and repair

.2 Maintenance and repair of ship communication systems
.1 Ship Communication Systems:
  .1 frequency ranges used in marine communication
  .2 diagram showing main components of receiving and transmitting lines of radio communication equipment
  .3 antenna types
  .4 disturbances
  .5 GMDSS, its purpose and structure
  .6 components of GMDSS,
  .7 Inmarsat Sat C, NBDB telex terminal with MF/HF transceiver, DSC, NAVTEX, EPIRB, SART
  .8 emergency power supply of ship communication systems
  .9 operation and maintenance

2.4 MAINTENANCE AND REPAIR OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS OF DECK MACHINERY AND CARGO-HANDLING EQUIPMENT

.1 Maintenance and repair of electrical, electronic and control systems of deck machinery

.1 Deck machinery

.1 mooring winches
.2 windlasses
.3 accommodation ladder winches
.4 lifesaving boat winches
.5 hatch covers winches
.6 specific reference

.2 Maintenance and repair of electrical, electronic and control systems of cargo handling equipment

.1 Deck cranes

.1 main components of electrical, electronic and control systems
.2 routine inspection, maintenance and repair of deck cranes equipment

.2 Reefer Containers

.1 inspection, maintenance and repair of reefer containers

.3 Cargo systems on tankers

.1 principle of operation of electrical, electronic and control systems of cargo systems on tankers
.2 inspection, maintenance and repair of cargo systems on tankers

.3 Electrical and electronic systems operating in flammable areas

.1 Electrical and Electronic Systems Operating in Flammable Areas

.1 parameters of flammable substances LEL, UEL, temperature class, split on groups and subgroups
.2 hazardous area on zones or divisions
.3 explosion-proof type for gas-explosive area
.4 explosion-proof type of protection of electrical equipment for dust-explosive area
.5 type of protection of non-electrical equipment
.6 rules of cabling running in hazardous area
.7 marking of explosionproof equipment
.8 maintenance of electrical explosion-proof equipment
.9 IECEx, ATEX and North America approach
.10 Ex certificate

.4 Safety and emergency procedures

.1 Safety And Emergency Procedures

.1 safety and emergency procedures during alarms
.2 permission to work and co-ordination of work
.3 Safety Electrician and assisting person assigned for dangerous job, who is familiar with safety procedures in case of accident
.4 plan of carrying out exemplary dangerous job

2.5 Maintenance and repair of control and safety systems of hotel equipment

.1 Maintenance and repair of control and safety systems of hotel equipment

.1 Elevators

.1 main parts of ship elevator

.2 working modes

.3 safety devices

.4 maintenance procedures

.5 diagnostic system for troubleshooting and repairs

.6 operation, testing and repair of elevator trap alarm or intercom

.2 Galley Equipment

.1 power supply circuits for galley equipment

.2 operation, maintenance and repairs of typical

.3 Laundry equipment

.4 Hotel safety and alarm systems

.5 Hotel lighting systems

3. CONTROLLING THE OPERATION OF SHIP AND CARE PERSONS ON BOARD

3.1 ENSURE COMPLIANCE WITH POLLUTION PREVENTION REQUIREMENTS

.1 The precautions to be taken to prevent pollution of the marine environment

.1 International Convention for the Prevention of Pollution from Ships, 1973, and the Protocol of 1978 relating thereto (MARPOL 73/78)

.1 Annex I – Oil

.2 Annex II – Noxious Liquid Substances in Bulk

.3 Annex III – Harmful Substances Carried by Sea in Packaged Forms, or in Freight Containers, Portable Tanks or Road and Rail Tank Wagons

.4 Annex IV – Sewage

.5 Annex V – Garbage

.6 Annex VI – Air pollution

.2 Anti-pollution procedures and associated equipment

.1 Basic knowledge of Regulation 26 Annex I MARPOL 73/78

.2 Basic knowledge of anti-pollution equipment required by national legislation

.3 Importance of proactive measures

3.2 PREVENT CONTROL AND FIGHT FIRE ON BOARD

3.3 APPLICATION OF LEADERSHIP AND TEAMWORKING SKILLS

.1 Introduction to management

.2 Related conventions and national legislation

.1 Related Conventions and National Legislation

.1 Maritime Labour Convention, 2006 (MLC)

.2 provisions in the STCW Convention and Code

.3 national legislations

.3 Applies task and workload management

.1 Applies Task and Workload Management

.2 Applies effective resource management and decision making

.1 Applies Effective Resource Management and Decision Making