



भारत सरकार / GOVERNMENT OF INDIA
पत्तन, पोत परिवहन और जलमार्ग मंत्रालय
MINISTRY OF PORTS, SHIPPING AND WATERWAYS
समुद्रीय प्रशासन महानिदेशालय, मुंबई
DIRECTORATE GENERAL OF MARITIME ADMINISTRATION, MUMBAI

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DGMA EAC Branch Circular No.49 of 2026

Subject: Preparatory courses for MEO and ETO grade of CoC examinations, reg.

References:

- MS Notice No.6 of 2000
- MS Notice No.13 of 2007
- STCW Circular No. 8 of 2012
- STCW Circular No. 9 of 2012
- DGS [EAC] Circular No. 02 of 2022
- Training Circular No. 3 of 2019

Part A

I. Background

- The Directorate General of Maritime Administration (DGMA) presently prescribes structured preparatory courses to assist candidates in preparing for the Certificate of Competency examinations for the grades of Chief Engineer Officer and Second Engineer Officer (Motor/Steam), conducted through approved Maritime Training Institutes (MTIs).
- The existing syllabus for these preparatory courses was last comprehensively revised some years ago and has, since then, been updated only in a piecemeal manner. In the intervening period, there have been significant developments in ship technology, statutory requirements, and international training standards, that are not adequately reflected in the current course content.

II. STCW Requirements

Regulation I/6 of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, as amended, requires that the training and assessment of seafarers be structured in accordance with the provisions of the Convention and the STCW Code.

Further, Regulation I/11 of the Convention requires certificate holders to demonstrate continued professional competence. Regulation III/1 prescribes the minimum standards of competence for Officers in Charge of an Engineering Watch, Regulation III/2 specifies the standards for Chief Engineer Officers and Second Engineer Officers, and Regulation III/6 prescribes the minimum standards of competence for Electro-Technical Officers.

Sections A-I/6, A-III/1, A-III/2 and A-III/6 of the STCW Code require candidates to acquire the prescribed knowledge, understanding and proficiency, and to demonstrate the competencies specified therein, prior to the issuance of the relevant Certificate of Competency.

III. Revision of the Syllabus for existing preparatory courses & assess the need for preparatory course for MEO Class IV and the ETO grade of examinations.

The Directorate General of Maritime Administration (DGMA), in exercise of the powers conferred under the Merchant Shipping Act, 2025 as amended, constituted a Technical Committee comprising representatives from the DGMA, domain experts from various industry organizations and professional bodies and approved Maritime Training Institutes (MTIs) to undertake the following:

- (a) revisit the need for preparatory courses for different grade(s) of Engg./ETO CoC examinations;
- (b) review existing training framework and course syllabi for Marine Engineer Officers and Electro-Technical Officers.

1. Review of preparatory course syllabus for Chief Engineer Officers [MEO Class I] and Second Engineer Officers [MEO Class II] on ships powered by main propulsion machinery of 3000 kW and above.

The Technical Committee has reviewed the feedback received from examiners, MTIs, ship owners/managers, recently qualified officers, and has identified the following factors that necessitate a revision of the preparatory course syllabus for the MEO Class I and MEO Class II grades:

- Amendments to the STCW Convention and Code, and updated IMO Model Courses, which require closer alignment of shore-based preparatory training with current competence tables.
- Widespread adoption of electronically controlled, dual-fuel, and hybrid propulsion systems, requiring updated technical content on engine management systems, automation, and control engineering.
- Growing use of alternative and low-carbon fuels (LNG, methanol, ammonia, biofuels) and the associated safety, bunkering, and operational procedures.
- Statutory and environmental developments, including MARPOL Annex VI updates, EEXI and CII requirements, and their implications for engine room operations and record-keeping.
- Increasing shipboard digitalization, cyber-security exposure, and condition-based/predictive maintenance practices.
- Observed trends in examination performance, including subject-wise pass percentages, indicating specific areas of candidate weakness that the current syllabus does not adequately address.
- The need to strengthen engine room resource management, leadership, and human element components in line with modern competency-based assessment.

The Committee proposed substantial revision to the preparatory course syllabus for the Chief Engineer Officer and Second Engineer Officer grades to include updated technical modules, revised course duration as detailed in the Revised Syllabus attached as Annexure's to this Circular.

2. Review of Preparatory Course requirement for Officer on Engineering Watch (MEO Class IV) & Electro-Technical Officer (ETO) CoC Examinations

The Technical Committee, after the detailed review, has submitted the following observations:

1. The candidates, especially those at the entry-level viz. MEO Class IV and ETO often struggle with initial Certificate of Competency (CoC) exams due to inadequate practical training quality, gaps in onboard vessel exposure, and lack of mentorship after completing their pre-sea courses. These candidates, after completing the minimum mandatory sea service, appear for the Certificate of Competency examinations without adequate academic revision, structured preparation, or post-sea-service technical orientation. Rote learning fails candidates during oral assessments conducted, when deep fundamental comprehension is tested
2. The Committee observed that a significant number of candidates require considerable time and multiple attempts to successfully complete the examinations, achieve the necessary level of competency, before a CoC can be awarded in accordance to the STCW Convention and Code and the Merchant Shipping (STCW) Rules, 2014, as amended.
3. The Committee recognized the need to strengthen the existing training framework to effectively bridge the gap between practical shipboard experience and the knowledge, understanding, proficiency, and competencies prescribed under the STCW Convention and the STCW Code.
4. The non-mandatory preparatory courses and the E-learning modules have not been successful in effectively stemming the failing standards of the entry level CoC examination candidate. The Committee emphasized the need for a comprehensive revision to incorporate the latest amendments to the STCW Convention and the STCW Code, the technological advancements, emerging innovations, digitalisation, automation, environmental sustainability, the human element, cyber risk management, and other developments in international maritime standards and industry best practices.

The DGMA has accepted the Committee's recommendation for introduction of mandatory preparatory courses for candidates appearing for the MEO Class-IV and Electro-Technical Officer (ETO) Certificate of Competency examinations. The revised framework is intended to strengthen candidates' technical knowledge, professional competence, and examination preparedness, thereby enhancing compliance with the STCW Convention and improving the quality of certificated marine engineering officers.

Part B

IV. Introduction of MEO Class-IV Preparatory Course

Recognizing, the need to have a structured learning programme for the candidates who after completion of the pre-sea training, have undergone the mandatory shipboard training and are eligible to appear for the Certificate of Competency as Officer in charge of an Engineering watch [MEO Class IV], the Directorate General of Maritime Administration, as recommended by the technical committee, hereby introduces a one-month Preparatory Course for the MEO Class-IV, Certificate of Competency Examination candidates.

The Preparatory Course shall be mandatory for the following categories of candidates:

- a) all candidates applying for eligibility assessment or intending to appear for the MEO Class-IV Certificate of Competency written and/or oral examination for the first time on or after 01 January 2027; and
- b) candidates who have not appeared for either written or oral examinations for any of the functions of the MEO Class-IV grade examination, in the calendar year 2026, and intend to appear written or oral examination on or after 01 January 2027.

Successful completion of the Preparatory Course shall be a pre-requisite for eligibility to appear in the MEO Class-IV Certificate of Competency examination for the above categories of candidates.

The detailed course framework and syllabus of the Preparatory Course are enclosed as **Annexure-I** to this Circular.

V. Revision of Preparatory Courses for Chief Engineer Officer [MEO Class I] and Second Engineer Officer [MEO Class II] on ships powered by main propulsion machinery of 3000 kW and above.

The Technical Committee had undertaken a comprehensive review of the existing preparatory course syllabi for the MEO Class-II and MEO Class-I Certificate of Competency examinations.

The revised syllabi have been aligned with the competency requirements prescribed under Regulation III/2 of the STCW Convention, Section A-III/2 of the STCW Code, and the associated Tables of Competence, taking into account the latest technological advancements, digitalization, automation, environmental sustainability, the human element, cyber risk management, and other developments in international maritime standards and industry best practices.

The DGMA has accepted the recommendations of the Committee and the preparatory course duration has been altered as under:

Name of the Course	Existing Duration	Revised Duration	Effective Date
MEO Class-II Preparatory Course	Four Months	Three Months	01 January 2027
MEO Class-I Preparatory Course	Two Months	No Change (Two Months)	01 January 2027

Accordingly, the following shall apply:

1. The revised MEO Class-II Preparatory Course duration of three months shall be applicable to all batches commencing on or after 01 January 2027.
2. Candidates admitted to the MEO Class-II Preparatory Course prior to 01 January 2027 shall continue under the existing four-month course duration and syllabus.
3. All Maritime Training Institutes (MTIs) approved by the Directorate General of Shipping and conducting MEO Class-I and MEO Class-II Preparatory Courses shall adopt the revised syllabi with effect from 01 January 2027.

4. MTIs shall revise their curriculum, lesson plans, teaching schedule, training material, and internal assessment methodology to ensure compliance with the revised syllabus and course duration.
5. The revised course frameworks and syllabi for the MEO Class-II and MEO Class-I Preparatory Courses are enclosed as **Annexure-II** and **Annexure-III**, respectively.

VI. Introduction of Electro-Technical Officer (ETO) Preparatory Course

The Technical Committee reviewed the existing training framework for Electro-Technical Officers prescribed under Regulation III/6 of the STCW Convention, the Merchant Shipping (Standards of Training, Certification and Watchkeeping for Seafarers) Rules, 2014 and the applicable Orders/Circulars/Notices issued by the DGMA. The Committee observed that ETO candidates generally do not undergo any structured academic revision or technical orientation after completion of the mandatory shipboard training.

The Committee further observed that the absence of a structured preparatory course has adversely affected the performance of candidates in the Electro-Technical Officer (ETO) Certificate of Competency written and oral examinations.

Accordingly, the Directorate General of Maritime Administration hereby introduces a one-month Preparatory Course for the Electro-Technical Officer (ETO) Certificate of Competency Examination.

The implementation schedule of the mandatory preparatory course for the ETO candidates shall be applicable as under:

- a) all candidates applying for assessment or appearing for the Electro-Technical Officer (ETO) Certificate of Competency written and/or oral examination for the first time on or after 01 January 2027; and
- b) candidates who have not appeared for either written or oral examinations of the Electro-Technical Officer (ETO) Certificate of Competency examination after completion of Eligibility assessment, in the last calendar year 2026, and intend to appear for the examination on or after 01 January 2027.

Successful completion of the Preparatory Course shall be a prerequisite for eligibility to appear in the Electro-Technical Officer (ETO) Certificate of Competency examination for the above categories of candidates.

The detailed course framework and syllabus of the Preparatory Course are enclosed as **Annexure-IV** to this Circular.

VII. Approval of Preparatory courses for MEO Class-IV and ETO grade

The Training Branch of the Directorate General of Maritime Administration shall issue separate Course Approval Guidelines governing, *inter alia*:

- infrastructure requirements;
- faculty qualifications and requirements;
- course duration and training hours;
- assessment and evaluation methodology;
- attendance requirements;

- quality assurance standards; and
- other criteria for the grant and continuation of course approval.

Maritime Training Institutes (MTIs) approved by the Directorate General of Maritime Administration for conducting MEO Preparatory Courses and intending to conduct the MEO Class-IV and Electro-Technical Officer (ETO) Preparatory Courses, may make the necessary arrangements to obtain approval for the respective courses and commence training from 01 November 2026, thereby enabling eligible candidates to comply with the mandatory preparatory course requirements applicable from 01 January 2027.

VIII. The candidates are required to attend the preparatory courses as mentioned above mandatorily. The e-learning module for the MEO Class IV candidates shall not be mandatory, but all CoC exam candidates are encouraged to avail the e-learning facility offered by the DGMA for enhancing their knowledge, self-assess and track their progress. The candidates who are onboard can continue to learn, update their knowledge at their convenience through e-learning facility.

This Circular is issued with the approval of the Competent Authority.



(Praveen Nair)
Dy.Chief Surveyor cum Sr.DDG(Tech)
DGMA

To

1. The Principal Officers, Mercantile Marine Department, Mumbai/Kolkata/Chennai/Kandla/Kochi.
2. The Surveyor-in-Charge, Mercantile Marine Department, Goa/Jamnagar/Port Blair/Visakhapatnam/Tuticorin/Noida/Haldia/Paradip/Mangalore
3. Indian National Shipowner's Association (INSA), Mumbai.
4. Indian Coastal Conference Shipping Association (ICCSA), Mumbai
5. Institute of Marine Engineers (India)
6. The Chief Surveyor with the Govt.of India
7. Engineering Wing
8. Training Branch
9. Hindi cell
10. Computer cell

Syllabus for MEO Class I Preparatory Course

Duration: Two months (8 weeks, 40 working days, 240 contact hours)

The Marine Engineer Officer (MEO) Class-I Preparatory Course shall be designed to prepare candidates for the Written and Oral Examinations leading to the award of the Marine Engineer Officer Class-I Certificate of Competency (CoC) in accordance with the requirements of Regulation III/2 and the relevant provisions of the STCW Convention, 1978, as amended, including the associated sections of the STCW Code.

The course shall be conducted as a fully offline programme over a duration of eight (8) weeks, comprising 40 working days and 240 contact hours.

The course shall comprise the following syllabus:

1. Knowledge of national maritime legislation, including the Indian Merchant Shipping Act, 2025, Rules framed thereunder; and, understanding of international maritime instruments such as treaties, conventions, protocols and codes, including their processes of formulation and adoption, with particular reference to the United Nations Convention on the Law of the Sea, 1982 (UNCLOS). Understanding of the role and functions of the International Maritime Organization (IMO), including knowledge of major IMO Conventions and instruments relating to maritime safety, prevention of marine pollution, liability and compensation regimes, and other associated maritime regulatory subjects.
2. Overview of Quality, Safety and Energy Management Systems in maritime organizations with reference to the International Safety Management Code (ISM Code) and ISO 9001:2008, including their interrelationship and application on board ships. Introduction to IMO guidelines on the ISM Code issued by the International Maritime Organization, and their linkage with ISO 14001, OH&S systems and ISO 50001. Principles of shipboard internal auditing, including types of audits, auditing techniques, audit reporting, identification of non-conformances and corrective/preventive actions. Overview of certification requirements for quality management and ISM systems including DOC and SMC, and introduction to the concepts of Total Quality Management (TQM) and continuous improvement in maritime organizations.

3. Overview of Classification Societies and their functions in ensuring the safety, structural integrity and seaworthiness of ships, including statutory certificates and documents under international conventions. Study of the role and duties of classification societies, principles of ship classification, and classification surveys including continuous surveys of machinery and hull, other survey methods, and enhanced special survey programmes. Procedures for assignment, maintenance, suspension and withdrawal of class. Role of Classification Societies as Recognized Organizations to flag administrations for statutory survey and certification of ships. Duty of care and responsibilities owed by Classification societies. RO Code and RO monitoring by maritime administrations. Ship inspections for first entry into the Indian flag with reference to the Merchant Shipping Act, 2025 and the Merchant Shipping (Registration of Indian Ships) Rules, 2026 relating to registration and compliance requirements. Introduction to open registry and its implications in international shipping.
4. Principles of ship stability including stability during dry docking, damage stability in cases of flooding or grounding, and countermeasures to maintain adequate stability. Overview of relevant requirements under the SOLAS Convention Chapter II-1 relating to subdivision, stability, trim and structural stress, and relevant provisions of the MARPOL Convention. Introduction to the International Code on Intact Stability 2008 (2008 IS Code) covering mandatory and recommended stability criteria for safe ship operation. Basic understanding of probabilistic damage stability assessment, including ship collision damage analysis and the treatment of variables such as ship speed, collision angle, type and displacement in stability evaluation.
5. Overview of Official Log Books, including their purpose, statutory significance and maintenance in accordance with the Merchant Shipping Act, 2025 and relevant rules. The Official Log Book serves as the formal record of a ship's voyages and significant events on board, acts as a communication link between the Master and the Administration, and is a legally admissible document in court proceedings. Emphasis is placed on legislative requirements for proper upkeep and accurate entries in compliance with statutory provisions.
6. Monitoring and control of compliance with legislative requirements relating to safety of life at sea and protection of the marine environment, including knowledge of conventions adopted by the International Maritime Organization. Statutory shipboard certificates and documents, their issuance and validity, and responsibilities under the International Convention on Load Lines, International Convention for the Safety of Life at Sea (SOLAS), and International Convention for the Prevention of Pollution from Ships (MARPOL), along with relevant national legislation such as the Merchant Shipping Act, 2025. Chief Engineer's role in tanker vetting and inspection programmes such as the Ship Inspection Report Programme (SIRE), Tanker Management and Self-Assessment (TMSA), and the RightShip Inspection Programme, together with marine environmental awareness and industry best practices recommended by International Chamber of Shipping, INTERTANKO, BIMCO, and Oil Companies International Marine Forum. Managerial oversight of BWMS commissioning testing and malfunction reporting.

7. Knowledge of ship security systems in accordance with the International Ship and Port Facility Security (ISPS) Code, including mandatory requirements and guidance contained in Part A and Part B under SOLAS Chapter XI-2, and coverage of piracy threats and anti-piracy measures, including existing and proposed counter-piracy practices and industry guidance.
8. Knowledge of the role of the World Health Organization in global public health, including monitoring disease outbreaks and health systems, and the provisions of the International Health Regulations (2005) relating to shipboard health documentation such as the Ship Sanitation Control Exemption Certificate and Ship Sanitation Control Certificate, which replaced the earlier Deratting / Deratting Exemption Certificates. The requirement for the Master to complete the Maritime Declaration of Health using the standard international form, reporting particulars such as the validity of Ship Sanitation Certificates and the number of passengers and crew, as well as awareness of WHO Guidelines for Drinking Water Quality. Role of the International Labour Organization with an overview of the MLC, 2006 requirements relating to the Maritime Labour Certificate, Declaration of Maritime Labour Compliance and defending the ill-treatment of seafarers in foreign ports with clear knowledge of Universal Declaration of Human Rights and International Covenant on Civil and Political Rights.
9. Knowledge of Port State Control as the inspection of foreign ships in national ports to verify compliance with international regulations relating to ship condition, equipment, manning, and operation. Updates on Port State Control directives, the concept, role, and duties of the Flag State in exercising regulatory control over ships registered under its flag, and responsibilities as outlined by the International Chamber of Shipping and the International Shipping Federation. Coverage shall also include participation in the IMO Member State Audit Scheme, commitments under regional Memoranda of Understanding (MoU), relevant instruments used by MoU authorities, inspection procedures, rectification and detention, appeal procedures and the importance of Detention review panels, provision of information by authorities, operational violations, and procedures for proposing and enforcing amendments to MoU provisions.
10. Knowledge of ship survey and certification requirements, including the principles of the Harmonized System of Survey and Certification (HSSC). Types of statutory surveys such as initial, annual, intermediate, periodical, renewal, non-periodical surveys, in-water surveys and additional surveys, their purpose and scope, general survey requirements, and the statutory certificates required to be carried on board ships under the harmonized system.
11. Knowledge of marine insurance including Hull and Machinery Insurance and the role and operation of Protection and Indemnity Clubs, covering principles of indemnity, mutuality, and third-party liabilities, and types of P&I covers such as cargo damage, collision, personal injury or death, pollution, wreck removal, crew repatriation, and stowaways. Charter party concepts

(time, voyage, and bareboat charter) and the Chief Engineer's role in compliance with charter party requirements, including fuel management, sampling, and machinery maintenance. Principles of marine insurance under the Marine Insurance Act 1906, general and particular average, and basic concepts of marine salvage under the International Convention on Salvage 1989 and the Lloyd's Standard Form of Salvage Agreement (LOF).

12. Knowledge of emergency preparedness and response for shipboard emergencies such as oil spill, fire, flooding, collision, grounding, and personnel accidents. Must cover emergency and damage control plans, vital damage control systems including communications, emergency power, pumping, fire main and drainage systems, and measures for effective response and drills. It shall include damage control strategies, emergency repairs, restoration of services, and coordination with authorities and owners. Accident case studies, root cause analysis, reporting procedures, and principles of risk assessment and risk management including ALARP in accordance with the International Safety Management (ISM) Code and industry best practices such as Tanker Management and Self-Assessment (TMSA). Also address detection, handling and restoration procedures for major machinery failures such as main engine bearing failure, turbocharger breakdown, boiler tube failure, lubricating oil contamination, and severe flooding of engine room bilges.
13. Study of human relations and modern management principles, including organizational behaviour and the influence of individual and group behaviour within organizations. The syllabus shall cover communication and information flow within organizations, conflict management, and the influence of human factors in shipboard systems. It shall include cross-cultural aspects of shipboard management, workload management, planning, coordination, delegation, prioritization, and effective resource management. Emphasis shall be placed on effective communication on board and ashore, leadership, motivation, assertiveness, decision-making techniques, situational awareness, and risk assessment. Coverage shall also include prevention of human error, corrective actions, development and implementation of standard operating procedures, and crisis management on board ships, including human behaviour during emergencies and the importance of drills. Psychological safety leadership, anti-harassment procedures and fatigue-risk management shall also be covered.
14. Study of training and instructional responsibilities of the Chief Engineer as a trainer for engine room personnel. The syllabus shall cover the skills required for effective training, including comprehension, conceptualization, creativity, and conduct, along with personal qualities such as confidence, communication ability, adaptability, and leadership. It shall include the training process comprising training needs analysis, design and development, and deployment of training. Emphasis shall also be placed on discipline on board, counselling, housekeeping, safety and

hygiene, mentoring and motivation through role modelling, and encouraging group participation and discussion for effective learning and team development.

15. Study of inventory management on board ships, including management of spares and stores, safety stock levels, and re-order planning using the Re-Order Point (ROP) concept, including lead time considerations. The syllabus shall also cover calculation and management of bunker fuel requirements, inventory control of fuel and lubricating oils, including the use of low BN cylinder oil for low sulphur fuels, and quality management of stored materials. Relevant case studies, including those from the Marine Accident Investigation Branch, shall also be discussed.
16. Study of Management Information Systems (MIS) in ship management, including computer system resources and computer-based information systems. The syllabus shall cover Decision Support Systems and Expert Systems, their role in problem solving and decision making, and the benefits of such systems in supporting operational and managerial functions. It shall also include types of Decision Support Systems such as knowledge-based systems, communication-driven DSS, data-driven DSS, document-driven DSS, and model-driven DSS. Oversight of MASS trials, remote operations, fundamentals of sensor technology, digital documentation & e-certification compliance.
17. Study of record management in the engine room, including preparation, maintenance, and interpretation of records relating to machinery operation and maintenance. The syllabus shall also cover the Chief Engineer's standing orders, night order book, updating of circulars, and maintenance of statutory records such as the Oil Record Book and other documentation required under the International Convention for the Prevention of Pollution from Ships (MARPOL).
18. Study of economising fuel consumption on board ships, including effective power balancing and propulsive characteristics of diesel engines in relation to speed, output and fuel consumption. Bunker management, use of low sulphur fuels and fuel change-over procedures, fuel quality requirements in accordance with the ISO 8217 marine fuel standard, and factors affecting vessel performance, including interpretation of engine load diagrams.
19. Study of budgeting and cost control in ship operations, including principles of cost value analysis for cost reduction and the classification of fixed and consumable costs. The syllabus shall cover voyage expenses such as bunker fuel, port charges, cargo handling costs, canal tolls, agency fees and commissions, as well as analysis of dry-docking and repair costs. It shall also include evaluation and contemporary methods in reduction of downtime; and, its impact on operational efficiency and expenditure.
20. Study of practical electricity and electronics including power electronics on board ships, including high voltage (HV) systems, their definition, applications, advantages, safety

requirements, busbar arrangements, insulation, short circuit effects and protection, generator and motor protection, and testing protocols such as insulation resistance measurement. Concepts of electrical propulsion including synchronous motor drives and Azipod propulsion systems, their construction, operation, advantages, limitations, maintenance requirements, and speed control using variable frequency methods such as Pulse Width Modulation. In addition, it shall include the use and application of circuit breakers in HV systems, particularly SF₆ and vacuum circuit breakers and their advantages in marine high voltage installations.

21. Study of recent developments in marine diesel engines and propulsion systems including dual fuel engines and contemporary technologies as may be adopted from time to time by eminent engine builders. Camshaft-less engines, electronic governors, common rail fuel injection systems, and control systems for electronically controlled engines. Recent developments in tribology such as advanced bearing lubrication techniques, alpha cylinder lubricator systems, fuel dilution in lubricating oils and methods of prevention, friction–speed characteristics in lubrication, and hydrodynamic lubrication of seals. In addition, developments in propulsion systems such as contra-rotating propellers, wake equalizing ducts, water jet propulsion, electrical propulsion, and PTO/PTI arrangements in modern propulsion systems. New innovations in supercharging systems, turbo chargers, turbo alternators and hybrid systems for improving overall plant efficiency. Additional management-level competence shall include supervisory responsibilities for alternative-fuel systems, including:

- integration of alternative-fuel risk assessments into the Safety Management System (SMS);
- oversight of bunkering operations for low-flashpoint and emerging fuels in accordance with applicable safety guidelines;
- evaluation of operational limits, safeguards, and fuel-system boundaries for safe machinery operation;
- incorporation of fuel-specific maintenance and inspection requirements into the Planned Maintenance System (PMS).

22. Study of greenhouse gas (GHG) emissions from ships, including statutory restrictions on EU waters; methods for monitoring, controlling, and reducing emissions in compliance with the latest IMO conventions. Understanding of carbon capture and carbon neutralization technologies, design and development of hull forms and optimization techniques to minimize wake and frictional resistance, propeller & rudder interaction; and, the application of new-generation low-friction, fouling-resistant, and environmentally compliant paints and coatings. Use of carbon-free and carbon-neutral fuels, along with emerging technologies for emission reduction, all in accordance with IMO regulations such as MARPOL Annex VI, the Energy Efficiency Existing Ship Index (EEXI), Carbon Intensity Indicator (CII), and the IMO Strategy for the reduction of GHG emissions from ships.

23. General understanding of Artificial Intelligence (AI) and its emerging applications in the maritime industry. The use of AI in ship navigation support systems, predictive maintenance of machinery, fuel efficiency optimization, voyage planning, autonomous shipping concepts, and data-driven decision-making in vessel operations and fleet management. Digitalization of maritime transport including the use of digital platforms, smart ships, integrated bridge systems, remote monitoring of machinery, electronic documentation, and the role of Internet of Things (IoT) in shipboard and port operations. Basic knowledge of blockchain technology and its application in shipping, including secure digital record-keeping, electronic bills of lading, cargo tracking, supply chain transparency, and improved coordination among shipowners, charterers, ports, and logistics stakeholders. Additional management-level competence in cyber-risk management under the ISM Code, including oversight of engineering-related cyber-risk controls, ensuring cyber-risk considerations are incorporated into the SMS, supporting internal audits on cyber-related systems and contributing to preparedness for cyber-incident response.
24. The study of Classic maritime casualties; Practices related to Casualty Investigations, related IMO guidelines and procedures.
25. Underwater noise; ship designs and operations to reduce such noise and allied areas.