



भारत सरकार / GOVERNMENT OF INDIA
पत्तन, पोत परिवहन और जलमार्ग मंत्रालय
MINISTRY OF PORTS, SHIPPING AND WATERWAYS

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DIRECTORATE GENERAL OF MARITIME ADMINISTRATION, MUMBAI

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A Note from the Chief Examiner of Engineers to MEO Class I candidates, offering guidance for improved success in the Certificate of Competency Written Examination

The Certificate of Competency written examination are held on a monthly basis and as a sample, the answer scripts of the MEO Class I written paper have been analysed by me. As seen in the past reviews, it has yet again been noticed that the failing marks are rarely due to a lack of core knowledge. Instead, candidates frequently fail because of **poor time management, misreading questions, and unstructured answers.**

Adhering to the following structural, technical, and tactical strategies will significantly increase your probability of success.

1. Pre-Examination Strategy & Mindset

- **Understand the Evaluation Standard:** The Certificate of Competency confirms that you can safely, legally, and effectively perform high-responsibility duties. Examiners look for **operational safety, regulatory compliance, and practical logic** rather than rote memorization.
- **The "Reading Time" Protocol:** If your examination provides reading time, utilize it exclusively to identify your strongest questions. Rank them in order of confidence and plan your execution sequence.

2. Deconstructing the Examination Questions

A critical error is answering the question the candidate *wishes* was on the paper, rather than the one actually asked. Pay strict attention to **Examiner Action Verbs**:

- **"State" / "List":** Requires only brief, direct points. Do not waste time writing lengthy paragraphs.
- **"Describe":** Requires a narrative breakdown of a process, component, or scenario. Use chronological steps where applicable.
- **"Explain":** Requires you to demonstrate *why* or *how* something happens. You must link cause and effect.

- **"Sketch and Describe":** Requires a clear, labeled diagram accompanied by a text explanation. A flawless description without a sketch will automatically forfeit 50% of the allocated marks.

3. Structural Standards for Written Answers

To secure maximum marks, your answers must be easy for the examiner to read, navigate, and grade.

- **Lead with Direct Conclusions:** If a question asks for a specific diagnosis, decision, or calculation outcome, state the final answer clearly in the first two sentences. Follow with your supporting arguments.
- **The Bullet-Point Advantage:** Avoid dense blocks of text. Use bullet points for non-sequential factors and numbered lists for chronological steps. Start each bullet with a bolded keyword.
- **Visual Data Presentation:** When comparing two systems, regulatory codes, or operational procedures, **always use a table**. Keep table cells concise to present data clearly.
- **Sketches and Schematics:**
 - Use a ruler for straight lines.
 - Make diagrams large enough to fill at least half a page.
 - Ensure all labels are clear, horizontal, and use pointer lines that do not cross over one another.

4. Technical and Regulatory Precision

- **Quote Specific Frameworks:** Whenever you reference an operational standard, cite the exact **regulation, code, or legislative Act** (e.g., MS Act-Section, Regulation of the convention, reference to any specific maritime/engineering codes).
- **Show All Mathematical Work:** For calculation-based questions, write down the base formula before plugging in variables. Show every intermediate step. If your final numeric calculation is wrong due to a minor calculator error, you can still receive up to 90% partial credit if your methodology is clearly displayed.
- **Use Correct Technical Units:** State the exact units of measurement (e.g., kW, bar, kPa) at every stage of an equation and in your final answer. Leaving out units will result in an immediate deduction of marks.

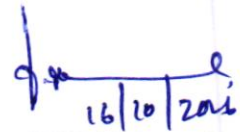
5. Time Management and Exam Room Tactics

- **Calculate Points-Per-Minute:** Divide the total exam time by the total marks available to determine your time budget. For a 100-mark, 3-hour (180-minute) exam, you have exactly **1.8 minutes per mark**. Do not spend 30 minutes on a 10-mark question.
- **Never Leave a Question Blank:** If you run out of time on a major question, stop writing full sentences. Switch immediately to a **punchy bulleted list** or a quick, labeled mind map. Examiners can award partial marks for keywords that demonstrate conceptual understanding.

- **Review Protocol:** Reserve the final 10 to 15 minutes of the examination period to verify that all question numbers are correctly written, formulas have units, and no sub-questions were accidentally overlooked.

The July 2026 MEO Class I paper was taken as a sample, and the gist of the review, question-wise is provided in a tabulated format for the benefit of the examination candidates and the Maritime Training Institutes offering the MEO Class I preparatory courses.

Hope you find these analysis useful. Wishing you success.



(Killi Mohana Rao)

Chief Surveyor cum Chief Examiner of Engineers

SOME GENERIC OBSERVATIONS

SR.NO (1)	OBSERVATION MADE (2)	EFFECT OF THE OBSERVATION MADE IN COLUMN "2" (3)
1.	A vast majority of candidates either do not read the questions carefully or, on account of their inadequate understanding of simple English are unable to interpret what has been actually asked in the question.	Hardly much credit can be given by the examiner to such answers.
2.	There is a clear tendency in a good many candidates to read the first few words of the question and write many pages, assuming that a lot of information has been conveyed to the examiner, which will earn them good marks.	The examiner comes to the conclusion that the candidate has written a lot on what he has studied, but not that which has been asked in the question. Such irrelevant answers hardly get any credit.
3.	The handwriting of quite a few candidates is illegible and untidy. At times, even simple sentences are written in English, which cannot be understood by the examiner.	The examiner keeps guessing what the candidate has intended to convey and even if the examiner intends to give the benefit of doubt to the candidate, he is unable to do so in most cases.
4.	The presentation of the answers is haphazard and badly crammed, while several pages of the answer booklet are left unutilized. Even the simple practice of starting a new answer in a fresh page is not followed.	Since it becomes highly tedious for the examiner to read that answer properly and make an objective assessment, there is a good possibility that the answer does not get the necessary credit.
5.	Answers are either wrongly numbered or illegibly numbered.	It becomes very difficult for the examiner to allot marks to the respective questions. If he repeatedly needs to keep labouring for such negligence on the part of the candidate, he will automatically draw negative impressions regarding the candidate. This surely has a negative effect on the marks.
6.	No distinction while answering a question is made in-between: "discuss"; "state"; "enumerate"; "explain"; "explain with justification"; "evaluate"; "list"; or a simple "what".	"Discuss" implies that the question is asking for explaining the subject / each point. Examine the subject more critically. "Enumerate" means the question is only asking for stating the main points / items, one by one.

		“Explain” means the question is asking for making the subject/issue clear by describing how or why something is done or happens. “state” and “what” implies that the question is generally asking for mentioning the required fact(s), rule, condition or information directly and precisely, without any detailed explanation, unless asked for. “explain with justification” requires that not only the explanation has to be given in the answer, it should be backed by reasoning. The examiner will not be able to give appropriate credit, unless the answer adheres to the above. For example, if the answer goes into a “discussion”, where only “state or “what” has been asked for, it is only waste of precious time (which he could have utilized in some other answer) for the candidate, and yet for which he gets no extra credit.
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SOME SPECIFIC OBSERVATIONS W.R.T THE ANSWERS WRITTEN

QUESTION NO. (1)	QUESTION (2)	SOME IMPORTANT ASPECTS MENTIONED / NOT MENTIONED / WRONGLY MENTIONED BY CANDIDATES (3)	SOME FUNDAMENTAL POINTS WHICH OUGHT TO HAVE BEEN MENTIONED IN THE ANSWER FOR GETTING PROPER CREDIT (4)
1.	(a) Discuss the application of formal safety assessment in loading and carriage of iron ore pellets as cargo in bulk. (b) What are the specific carriage & voyage monitoring	PLEASE REFER TO “1B” BELOW	PLEASE REFER TO “1A” BELOW

	requirements for a vessel transporting iron ore pellets?		
2.	There is a bunker overflow from a large merchant ship while in foreign waters, in which you are the Chief Engineer. State in systematic detail the actions which you will take: (i) Keeping in mind that the oil-spill / contamination needs to be kept to a minimum; (ii) The documentation that you will require to consider to be critical; (iii) Local regulatory reporting that you would mandatorily need to do; (iv) The cooperation that you would need to extend to the investigators; & (v) The liabilities which you are likely to face and thereby must guard against.	PLEASE REFER TO "2B" BELOW	PLEASE REFER TO "2A" BELOW
3.	(a) Enumerate the structure of IACS & explain the difference between UI, UR, PR from IACS. Does it have any significance to shipowners / operators? (b) What is a Recognized Organization (RO)? What are the salient features of the RO Code? How do Administrations monitor ROs?	PLEASE REFER TO "3B" BELOW	PLEASE REFER TO "3A" BELOW
4.	As the Chief Engineer of a large merchant ship, you are about to enter an Emission Control Area. Explain with justification the	PLEASE REFER TO "4B" BELOW	PLEASE REFER TO "4A" BELOW

	instructions you need to give to your colleagues with respect to the procedures to be followed regarding fuel change over, considering the boilers and engines. Enumerate the statutes involved, if any, in this regard.		
5.	Explain the concepts of “Particular Average” and “General Average”. What are the circumstances when a General Average can be declared? Who are Average Adjusters & what is their role in General Average loss situations?	PLEASE REFER TO “5B” BELOW	PLEASE REFER TO “5A” BELOW
6.	Evaluate the use of Green Ammonia as a zero-carbon marine fuel. What are the primary safety, storage and combustion challenges of using Ammonia in marine internal combustion engines versus fuel cells.	PLEASE REFER TO “6B” BELOW	PLEASE REFER TO “6A” BELOW
7.	India has recently taken significant legislative measures that are critical to streamlining maritime governance & bringing India’s shipping regulation in line with global practices. Explain the significance of the Merchant Shipping Act, 2025, particularly in the context of how it shall contribute to trade & tonnage expansion, attract foreign investment & enhance its maritime standing, aligning with global best practices.	PLEASE REFER TO “7B” BELOW	PLEASE REFER TO “7A” BELOW
8.	(a) In the context of the Human Element, explain the difference between “crew competence” and “crew performance”. Discuss the role of ongoing training & drills in ensuring that competence translates into high performance, specially during emergencies. (b) Discuss the positive and negative effects of advanced	PLEASE REFER TO “8B” BELOW	PLEASE REFER TO “8A” BELOW

	technology and automation on the Human Element in shipping.		
9.	Explain the principle of “uberrimae fidei” in marine insurance. What are different disclosures which must be made by the insured to the insurer in a marine insurance? List the circumstances which need not be disclosed to the insurer? What happens to the marine insurance contract if the disclosures are not made to the insurer at the time of conclusion of the contract?	PLEASE REFER TO “9B” BELOW	PLEASE REFER TO “9A” BELOW

1A Formal Safety Assessment (FSA) is a systematic Risk Assessment Methodology which can be professionally used to identify the hazards, quantify associated risks and determine whether additional safeguards are justifiable (concluded after a cost benefit assessment). This process contributes majorly to the IMO’s rule-making process.

- (1) The system involved is basically: Loading the pellets – suitable trimming (to reduce the risk of cargo shifts during rough seas) – completing the loading exercise and finally completing the voyage to the discharge port.
- (2) Iron ore **pellets** have a bulk density of approximately 1900 – 2400 kg/m³, not quite combustible, with low fire risk and has no special or ventilation needs. Normally not liquefiable nor chemically reactive.

Note: if the pellets are Direct Reduced Iron (DRI) rather than raw iron -ore pellets, they introduce a completely different chemical hazard, including self-heating, oxygen depletion and explosive hydrogen generation.

The usual steps related to FSA, in this case, are as follows: -

Hazards envisaged: (a) excessive local loading of the tank top, leading to structural overstressing, because of high density & uneven spreading of pellets; (b) excessive longitudinal bending moments and shear forces arising out of uneven distribution; (c) excessive loading stresses during rapid cargo operations; (d) their spherical shape makes them prone to rolling and sliding if the ship lists heavily, though they would not turn into liquid state; besides, due to unsystematic cargo distribution, stability of the ship may be affected; (e) cargo causing the choking of bilge wells, affecting bilge operations; (f) erroneous preparation and implementation of the loading plan, and; (g) incompatibly coordinated ballasting.

Assessment of the risks (i.e. what can go wrong and how frequently & what could be the consequences).

Tank top overstress: permanent deformation / cracking – risk is high

Excessive hull stress: structural damage – risk is high

Excessive trim / list: loss / reduction of stability – risk is high

Excessive loading rate: incompatible ballasting – risk medium

Bilge blockage: inability to pump bilges - risk medium

Human error: loading plan misunderstood / not followed – risk medium.

Note: Risk level is a combined function of probability & consequence.

Risk Control options (i.e. what measures will reduce those risks)

- Proper loading plan: cargo distribution must be calculated to ensure that - the tank-top strength limits are not exceeded, shear force / bending moments are within limits, stability criteria are satisfied.
- Controlled loading sequence: the sequence of loading ought to prevent a heavy concentration of pellets in one area.
- Trimming: pellets should be properly distributed / trimmed in keeping with the IMSBC Code, rather than forming a concentrated heap.
- Ballast Coordination: loading and ballasting-operations need to be compatible to each other, more so since bulk carrier loading rates can be extremely high.
- Verification: before and during loading – verify cargo quantity, verify the loading sequence, monitor drafts, monitor list and trim, monitor stresses/shear forces /bending moments, ensure that the bilge wells are clean, dry and appropriately covered.

Consider the risk control options vis-à-vis the costs involved & practical feasibility.

To illustrate with an example: if the risk assessment identifies tank-top overstressing of the tank-top as a high risk, the possible control options could be, reduction of the maximum quantity loaded into the individual holds; reconsider a specified loading sequence; ensure more thorough trimming; reduce the loading rate; modify the ballasting operations compatibility vis-à-vis the loading rate / sequence.

The FSA would then compare these various options vis-à-vis their practical feasibility, costs involved and the consequences, and then suitably select the most prudent safety measure.

Make recommendations for safety measures

Considering all of that as mentioned in the previous paragraph, the FSA ought to make necessary recommendations, such as:

- (i) Amendments to the International Maritime Solid Bulk Cargoes Code (IMSBC Code);
- (ii) Modified loading procedures;
- (iii) Requirements for loading manuals / computers;
- (iv) Terminal-ship loading agreements;
- (v) Improvements in crew training; &
- (vi) Additional structural & operational requirements.

Specific carriage & voyage monitoring requirements for a vessel transporting iron ore pellets.

- **Hull structural condition** – this is the most important criteria. On account of the exceptionally high density of this cargo, the IMSBC specifically requires being alert on overstressing of the tank-top during loading and while on voyage. For this purpose, abnormal list, draft & trim, loading-computer indications of BM and SF as applicable; any indication of abnormal hull deformation / structural damage.
- **Cargo distribution / possible shifting** – while the cargo should have been properly trimmed while / after being loaded, during the voyage the crew should remain alert for any indication of abnormal cargo movement (particularly after encountering heavy seas) and disturbance of stability of the vessel;
- **Bilge Condition** – the bilge wells ought to be clean, dry and appropriately covered (usually with a perforated strainer plate or grating, duly secured) to prevent

ingress of cargo, which is liable to block the bilge suction. To check - bilge level, functionality of the bilge alarms; bilge-wells have not become blocked by the pellets and in case there is any unexpected accumulation of water.

1B

Vast majority of candidates have not laid necessary emphasis on the issues related to structural stress, stability and bilge-well choking. Strangely, even though the question relates to the carriage of iron-ore in pellet-form (for which cargo liquefaction seldom arises), a good number of candidates have repeatedly written about moisture-absorption, Transportable Moisture Limit, liquefaction of cargo which are applicable usually for the carriage of iron ore fines and not as pellets. Obviously, when the question is fundamentally not answered correctly, the answer does not get the entitled credit.

Note 1: It may also be noted that the aforesaid model answers are strictly for illustrative and suggestive purposes. They are intended as a preliminary reference and do not, in any manner, imply that further modifications, technical improvements, updates or contextual adaptations are not required. Users and implementing authorities must exercise independent institutional due diligence to refine and finalize these outputs in accordance with the applicable statutes and specific field requirements.

2A

- (1) Immediate priority: raise the alarm and immediately stop bunkering. Inform the bunker supplier / barge or terminal is instructed to stop pumping.
- (2) Stop any ship's transfer pumps involved;
- (3) Close the appropriate manifold and tank inlet valves, taking care not to create excessive pressure in the bunker line;
- (4) Inform Master immediately and activate ship's emergency response arrangements.

Identify

- (5) Which tank has overflowed;
- (6) Whether the cause is overfilling, incorrect line / valve-setting; defective valve, faulty level indication, excessive pumping rate, or any other system failure;
- (7) Whether oil is continuing to enter the tank or spilling on the deck / surrounding waters.

Containing the oil on board

This is the single-biggest-priority after taking care of safety issues. In compliance of the ship's SOPEP (including the SMS):

- Plug all scuppers & drains;
- Use save-alls, drip trays, absorbent pads etc.
- Prevent the oil from reaching the ship's side
- Transfer the oil from the overflow tank, to a suitable tank which has good space
- Recover as much of the free oil from the deck, as is practicable, using appropriate pumps or other portable equipment

Minimize pollution of the water (more so if the oil has reached the waters overboard)

- Apprise the Master of the approx. volume & nature of the oil spilled;
- Deploy booms / other onboard containment equipment, unless these are unsafe for use;
- Cooperate with port / coastal spill-response personnel, without any let up on the recovery and containment as advised under the emergency response arrangements.

- Note: evidence gathering and preserving is a continuous process. Therefore, in parallel, as far as possible: preserve the electronic records of the associated alarms; ensure that no records are altered or removed; photographs ought to be taken showing the condition of the deck, source of the overflow and the containment measures that had been taken.

Documentation Critical

This is very important for establishing what happened, when it did happen & what action was taken in response.

- **Engine Room Log Book**, containing information on the overflow happening timing / being first noticed; tanks involved; source; immediate actions taken (i.e. say stopping of pumps; the valves operated) & transfers undertaken to contain the overflow.
- **Oil Record Book-Part I**, showing precise entries of the relevant operations. Under NO CIRCUMSTANCES, retrospective manipulation of entries are to be resorted to, to disguise the overflow and make it to appear other than that which actually happened.
- **Bunkering records**: bunkering plan (with tank allocation); bunkering checklist; sounding / ullage figures; any rate-of-transfer records, if available; BDN and associated documents & important communications with the bunker supplier, if recorded.
- **Incident records** as they happened(record the facts instantly, accurately & honestly): what/when/who-involved/actions taken/estimated quality spilled. If possible, all these are to be backed-up by electronic / physical evidence of tank-level-cum-alarm records; ER alarm printer records; CCTV recordings; valve/pump operating records & maintenance / calibration records, as applicable.

Mandatory Local regulatory reporting in foreign waters

It is to be borne in mind that “foreign waters” implies any maritime zone that falls outside the territorial jurisdiction of a vessel’s flag state, excluding the high seas. In other words, this incident is assumed to have happened in a maritime zone where another specific country holds legal authority.

So:

- The nearest Coastal State / Port State Authority has to be informed and any proof to that has to be recorded. For example, the Indian Coast Guard (MRCC) in Indian waters needs to be informed; the National Response Centre if in US waters.
Subsequently, the Harbour Master / Port Authority; shipowner / operator (DPA), flag Administration & local correspondent of the P&I Club need to be intimated. Notifying the Company alone is not adequate. Therefore, the Chief Engineer, would need to furnish all technical particulars to the Master, to enable him report all information to the authorities as per the local laws.
- If the ship is at a berth, at anchor or participating in STS transfer, immediately alert the terminal operator and the VTS via VHF.

Cooperation that needs to be extended to the investigators

As a Chief Engineer, it is very important to render all cooperation to the bona fide investigators, more so the statutory authorities. For this purpose it is to be ensured that the information / documentary evidences expected to be sought by the investigators are not only kept ready but

arranged systematically, presented decently (with no illegibility) and readily accessible. For this purpose:

- (i) make the relevant documents & technical records made available through the Master and in accordance with the Company procedures;
- (ii) Have the explanation of the fuel system, tank arrangements and the sequential bunkering operation, ready for the investigators;
- (iii) Identify the personnel involved in the bunkering operations (along with their duties) and keep them on stand-by, should the investigators desire to interact with them. They should be instructed to give factual accounts of what they personally observed or did;
- (iv) Assist the investigators in interpreting the alarm records and allied machinery data, as needed.

Under no circumstances should the Chief Engineer: -

- (i) alter, destroy or conceal records;
- (ii) Tutor the witnesses on what to / what not to inform the investigators.
- (iii) Speculate about facts / causes, that have not been established;
- (iv) Make statements which cannot be supported by evidence(s);
- (v) Attempt to attribute blame on anyone, without irrefutable proof.

However, the Chief Engineer should preferably consult the P&I correspondent and the Company (i.e. employer), before giving written depositions.

The liabilities which the Chief Engineer is likely to face and thereby must guard against

The Chief Engineer may be required to face several types of liabilities, based on the laws of the Coastal State, Flag State or other applicable statutes.

- (i) **Professional liability:** any authority could investigate whether there was any failure to adhere to the prescribed bunkering procedure; there was lack of supervision or familiarization with the bunkering procedure, by those involved; the line-set up and tank-planning was not done with due diligence; monitoring of the tank levels was not given due attention; there was failure of communication between the bunker supplier and the ship; the alarm system was not working properly or the alarms was not responded to with due seriousness; etc., etc.

Guard: Follow the laid-down bunkering procedure; maintain proper supervision / conduct trainings, along with drills; document all these actions and the salient decisions / actions forthwith, and maintain them for ready reference.

- (ii) **Local regulatory liability:** the Coastal / Port State may impose penalties, require investigations and detain the vessel, particularly if due cooperation is not extended to the investigators.

Guard: Ensure prompt and truthful reporting and keep every evidence handy in order to establish that all proper procedures and statutory requirements were adhered to.

- (iii) **Criminal Liability:** this is the liability against which the Chief Engineer must exercise the greatest caution. If personal criminal exposure arises in cases involving wilful or reckless conduct; gross negligence; deliberate concealment of facts; consciously making false statements; falsification of records; failure to act with integrity etc., it can lead to serious punishment including imprisonment and hefty fines.

Guard: always act with utmost sincerity and diligence; be transparent and truthful in all duties and actions, allow no scope for concealing or, wrong reporting, or falsification of records, or destruction of evidences; preserve necessary objective proofs in readily accessible, but safe custody; maintain decorum and politeness

(without being weak) in dealing with colleagues & authorities, alike.

2B

Knowing bunkering procedures has not been of much help in answering this question. The question clearly states that the overflow has already taken place, even though a large number of candidates have written many pages on the precautions to be taken, for the procedures related to bunkering. This gives the answer very little credit. The crucial part related to the liabilities which a Chief Engineer may face has been misconstrued by almost every candidate. Overall, most of the answers were substantially inadequate, wrong or vague.

3A

Basic structure of the IACS

IACS Council: the principal governing body, which formulates the overall policy and strategic direction in which the IACS should operate. It normally comprises the head (Chairman / President) of the member Classification Societies. High level international representation of IACS is decided by the Council. The chairmanship of IACS rotates among its member Societies. Under the Council is the General Policy Group (GPG): basically, coordinates the technical work undertaken by the IACS. Gives practical effect to the policies, the regulatory aspects framed thereto, as formulated by the Council.

Under the GPG, are the: Specialized Technical / Expert Working Groups: the bulk of the substantive technical hands-on work of the IACS, is carried out by these specialized experts. Subjects handled, include, hull structures & ship design; Machinery and Engine systems; Survey & Certification; Fire Safety Systems; Environmental Protection; cyber safety etc. Developing the Unified Requirements, Unified Interpretations & Procedural Requirements are also included in the scope of work of these technical / expert working groups.

There is a Permanent Secretariat of the IACS: usually headed by a Secretary General, providing administrative, technical and organizational support. Coordinates the interaction of the IACS with international bodies like the IMO.

Difference between UI, UR, PR from the IACS

Unified Interpretation (UI)	UR (Unified Requirements)	Procedural Requirements (PR)
Does not normally create a new technical requirement / provision. In fact, it provides a common interpretation of an existing requirement, such as, a provision of an IMO Convention, Code or similar international instrument. These UIs, in effect, prevent the possibility of varied interpretations by the member Societies or Flag Administrations or other stakeholders, of the not-as-simple provisos. The UIs therefore, promotes uniform understanding and	A harmonized technical requirement / rule (i.e. a minimum standard), developed by the IACS and adopted for implementation by the respective member societies, by incorporating these into their own Rules. Areas dealt with are as shown against, Specialized Technical / Expert Working Groups, above.	These are concerned with the methods, procedures and processes that are required to be followed by the IACS member societies, in carrying out classification activities. Their basic purpose is to assist and encourage consistent practices in the way member Societies perform functions such as surveys & inspections; classification & certification processes; transfer of class; suspension or withdrawal of class; etc.

application of certain existing requirements.		
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Significance of UIs, URs and PRs to shipowners / operators

UIs: these are significant since international conventions / regulations at time are unable to provide absolute clarity. These UIs therefore provide greater clarity / certainty to the shipowner / operator about how a statutory-technical requirement ought to be interpreted; how to prepare for surveys / inspections and the way in which compliance would be required to be demonstrated. At times, an UI can influence the need to modify operational decisions / documentation / equipment arrangement(s) on the part of the shipowner / operator.

URs: these are directly the most significant for shipowners and operators, since on these depend the technical standards incorporated into the Rules of the ship's classification society. These have a direct bearing on ship design / construction; machinery / equipment specifications; structural strengths & safety standards; survey, maintenance and repair requirements. Maintenance of the classification largely depends on these.

PRs

These are of significance when the shipowner / operator needs to deal with the RO. Such that there are transparent and harmonized procedural principles available, for example, say, conduct of surveys, dealing with Conditions of Class, solving issues related to suspension / withdrawal / reinstatement of Class; transfer of Class between IACS members etc.

What is a Recognized Organization?

An organization that has been assessed & authorized by a flag state (i.e. found to comply with the part, "recognition & authorization requirements for organizations", in the RO Code) to carry out statutory surveys, inspections, audits & certification on behalf of that flag State.

What are the salient features of the RO Code?

This Code establishes an internationally harmonized framework for Classification Societies that perform statutory services, verification and certification functions on behalf of flag states, regulates the way they perform the delegated statutory functions and provides a framework for enabling effective flag state oversight on the RO.

The salient features of the Code are:

- Provides a consolidated international standard with reference to which, an organization can be assessed for the purpose of being recognized and authorized by a flag Administration;
- The statutory functions to be performed by an RO on behalf of the Administration (e.g. under SOLAS; MARPOL; LOAD LINE etc.)
- The need to demonstrate the possessing of certain qualities by the RO, such as, technical competence and capability; having adequate qualified personnel and resources; be able to deal with independence and impartiality; have a professional organizational / management structure; properly supervised / controlled survey and certification activities & having a recognized quality management system (including internal controls) in place.
- Provides a clearly defined scope on the basis of which functions / duties can be delegated to it;
- Emphasizes the accountability of the RO to the Flag State and the need for oversight by the Flag State. This is very important, since although the RO can act on behalf of the Flag State, the latter remains fully responsible for ensuring proper implementation of its international obligations;

- It helps in promoting international uniformity and transparency in its functioning as an RO.

How do Administrations monitor ROs?

- Administrations perform systematic management and technical audits of the RO's systems (including their field duties and documentation activities), to ensure due adherence to the RO Code. If the performance of the RO is in suspect, additional audits of the RO at their expense; curtailment of the authorized scope of the delegated surveys & certifications; suspension / withdrawal of the RO's authorization agreement may be resorted to.
- Concerned authorities analyze Port State Control detention records, marine casualty reports, damage statistics and ship deficiency trends reflected in the fleet;
- On occasions, Flag State personnel physically witnesses the conduct of surveys and certification services by the RO's surveyors and other authorized personnel.

3B

The basic structure of the IACS has been stated correctly by very few candidates. The candidates virtually have no clear understanding of what are UIs, URs and PRs. Even if they do, they are unable to express themselves with any clarity and that is how they hardly get due credit. Not one candidate has answered the significance of UIs, URs and PRs to shipowners / operators.

Not even a handful few candidates have a clear idea of the salient features of the RO Code and how the Administrations monitor the ROs. Merely mentioning that the Administration carries out audits of the Societies does not allow the examiner to give proper credit to the answer.

4A

Plan the change-over well in advance. For this, the adequacy of the compliant-fuel (for the main-engine, auxiliary-engine, and boilers) on board for the whole voyage, the time and position of the ECA-entry and how early the change-over needs to commence, so that the pipelines, heaters, mixing-columns, the whole fuel-system in use, has no remnant non-compliant fuel, once the vessel crosses the ECA boundary, all need to be actively considered.

- The laid-down change-over procedure (usually contained in the SMS which is subject to audit. Approval of this procedure depends on the stipulations of the Flag / Class / Company) to and from the compliant-fuel, is read through and explained clearly to all involved, emphasizing the serious consequences, should the fully-compliant fuel not be used at the entry-point and till the exit-point from the ECA and, the means to demonstrate / establish this fulfilment, should the need arise.
- The operation should be carefully recorded in the relevant log-books and fuel change-over records, including time, position and quantities, as necessary.

The following need to be brought to the knowledge of all those involved / responsible for ensuring a proper and smooth change-over: -

Main & Auxiliary Engines (prime-mover for generator)

- The change-over ought to be carried out gradually, particularly when changing over from a heated residual fuel oil to a distillate / low-sulphur fuel. The fuel temperature should be reduced at a controlled rate, in accordance with the engine manufacturer's instructions.
- It is to be borne in mind that sudden temperature-changes can cause:

(a) thermal stresses to fuel pumps and associated injection equipment. This could lead to seizure / sticking of the components (since the lubricity falls), particularly those which have fine-

clearances, e.g. fuel injector nozzles/needle valves; barrel-plungers in the fuel pumps;

(b) leakage from seals and joints;

(c) unstable combustion.

- During and after the change-over the following parameters need to be closely monitored:

-

- (i) Fuel pressure & temperature; (ii) viscosity, as necessary; (iii) fuel filter differential pressures; (iv) leakage from pumps and pipe joints; (v) exhaust temperatures; (vi) funnel smoke; (vi) main-engine rpm and normalcy of other parameters; (vii) stability of the generator -frequency & load-sharing.

Auxiliary Boilers

- If the auxiliary boilers were running on hot, high-viscosity fuel, special precautions are needed;
- The change-over needs to be gradual, in accordance with the procedures laid down by the boiler-manufacturer;
- The temperature of the fuel to the burner must be appropriate to facilitate the necessary atomization;
- For stable combustion, the fuel temperature needs to be maintained. The funnel smoke may also be monitored at the start of the combustion of the compliant-fuel and back. The flame-condition also needs to be observed till such time the change-over is satisfactorily completed.
- As far as practicable, the change-over ought to be done when the boiler load is as less as possible, for obvious reasons.

Some practices related to status of machinery, other than those mentioned above

- (i) Any change-over ought to be done in a manner so that critical items of machinery do not undergo a vulnerable transition at the same time. Unless the vessel's established procedures for change-overs, specifically provides for simultaneous action, it should preferably be "one at a time";
- (ii) It is always prudent to maintain adequate electrical-generation redundancy;
- (iii) If possible, it is always better to avoid change-overs during critical manoeuvring;
- (iv) At all stages, communication between engine room and bridge should be well-maintained;
- (v) Stand-by trained manpower should be readily available to respond to emergencies arising out of unforeseen loss of propulsion power, generator instability / failure or boiler firing failure.

A gist of FOBAS

FOBAS – stands for: Fuel Oil Bunker Analysis & Advisory Service.

This is a testing and advisory service set-up by Lloyds Register, for which shipowners pay a subscription. Broadly speaking, it is useful for providing technical fuel analysis and advice that can help making the change-over / blending procedure safe on board, effective, and complying with the environmental compliance requirements.

The calculation sheet is required to be appended to the Marpol fuel change-over record-book, for establishing the regulatory compliance to designated authorities, as and when needed. In certain

sea-areas of the world, surprise Drones monitor the funnel exhaust for sulphur content in moving vessels and resort to stringent action as needed.

Depending on the speed of the vessel and approximate fuel consumption, appropriate timings for start and rate of shutting of the HFO valve, simultaneous rate of opening of the LSFO valve, sufficiency of volume of compliant-fuel oil in the service system to complete the entire voyage can be transparently acted upon and recorded.

As already mentioned above, it is essential to have the change-over gradual. Usually, a maximum drop in temperature of 2 degrees Celsius in one minute is found to be compatible to the extant machinery in use.

Statutes involved in this regard

- (i) MARPOL Annex VI (Regulations 14 & 18)
- (ii) SOLAS – ensuring the safety of the vessel’s propulsion system, fuel flash points and the crew.
- (iii) ISM Code – Safety Management System Procedures; Familiarization by personnel and their training, emergency preparedness.

4B

This question was attempted by quite a few candidates, with the assumption that as long as the FOBAS-calculator (without even expanding the acronym) is mentioned, the question is answered and passing marks will be given. It is not so, given the fact that the question is carrying 16 marks and it is meant to be answered at the MEO Class I Level, i.e. the highest seagoing Certificate of Competency.

Hardly any candidate made any mention of even the basic actions / monitoring necessary with respect to the auxiliary engines and the boilers.

A very few candidates mentioned Annex VI as the involved statute. The other statutes were not even mentioned by any candidate.

5A

General Average

This is a practice followed at sea in keeping with maritime law. A deliberate (i.e. done on purpose), reasonable (i.e. the sacrifice / expenditure must have been a sensible and justifiable response to the danger, judged according to the prevailing circumstances) and an extraordinary (i.e. it should be very unusual or remarkable) sacrifice (or expenditure), made to save the whole maritime venture, from a common peril / danger. In this practice, everyone having an interest in the completion of the voyage, must pay a share. The danger involved must be real (i.e. actually existing, not imagined or supposed) and apply to all the interests.

If, for example, in case of heavy weather a ship lists and the Master orders certain cargo to be thrown overboard to prevent the ship from capsizing, the action of throwing this cargo would usually be considered “reasonable” if:

- The danger of capsizing was genuine / realistic, as believed by the Master at that moment;
- The throwing of the cargo was considered as an appropriate emergency measure; &
- The amount and type of cargo sacrificed were not excessive or unnecessarily decided upon.

Particular Average

This is also a practice followed at sea in keeping with maritime law. It is a partial loss, suffered accidentally by a particular interest (i.e. one specific property interest or, one party's financial stake in the maritime adventure, as distinct from all the interests involved collectively).

The main interests in a voyage are :-

- (i) The ship – the shipowner's interest
- (ii) The cargo – the cargo owner's interest
- (iii) Freight – the party entitled to receive freight has an interest in it. (may be the shipowner. In the event of a time-charter, the charterer may earn the freight paid by cargo interests. In case of a voyage-charter, the shipowner usually receives the freight).

As an example, say, due to sea-water entering a particular hold during heavy weather, damages the cargo which belongs to one cargo owner, with the ship and all other cargo remaining undamaged. In this case, the loss affects only that cargo-owner's particular interest. This is therefore Particular Average. The other cargo owners and the shipowner do not have to contribute towards that loss, merely because they were involved in the same voyage.

Note: Property interest means a person's legal or financial stake in a property, i.e. the extent to which that person would suffer financially, if the property were damaged or lost.

Under what circumstances a General Average (GA) can be declared

In generic terms, when a vessel, her crew, and/or its fuel, and/or the cargo on board, are in common peril during a maritime venture / voyage, the Master, can reasonably order measures to be taken to save the vessel and/or its fuel, and/or the cargo on board, from this common peril.

To clarify further, GA is normally declared under the following prevailing circumstances :-

- (i) The vessel is experiencing a critical emergency, that threatens the survival of the entire voyage;
- (ii) The peril endangers all interests onboard simultaneously, including the ship, fuel, crew and all the cargo;
- (iii) The crisis cannot be managed through routine navigation, standard ship manoeuvres, or regular crew duties;
- (iv) The Master is forced to choose between letting the entire venture perish or deliberately sacrificing a part of it;
- (v) The vessel is physically unable to continue its planned route and must break its voyage for seeking immediate shelter.

Note: It may be borne in mind that the physical decision to perform a GA Act (i.e. the sacrifice) belongs solely to the Master (under international maritime law, the Master holds the ultimate legal obligation to preserve the common maritime adventure. However, the formal legal declaration of GA, is almost always made by the shipowner or the management, in close consultation with maritime experts).

Who are Average Adjusters & their role in General Average loss situations?

Average Adjusters – these are specialized, independent experts in maritime law and marine insurance who investigate, analyze, calculate and settle, financial liabilities, following a shipping accident. The adjuster's function is essentially to ensure that the financial consequences of a qualifying common sacrifice or extraordinary expenditure are fairly apportioned among the interests involved.

Role of the Average Adjusters in GA loss situations

- (i) Carefully consider the facts of the incident and examine what actions were taken and why.
- (ii) Examine which losses and expenses may qualify as GA. Not every loss arising from a casualty is a GA loss. Therefore, the adjuster assesses each item to determine whether it qualifies under the York-Antwerp Rules, when incorporated into the relevant contracts; and / or, the governing law and the contractual provisions. The adjuster determines the “contributory values” of the interests saved, i.e. normally the ship, cargo and, where applicable, the freight at risk. From this, a decision is taken on who should contribute, on what value, and precisely how much.

5B

A good many candidates attempted this question. However, whereas the question asks for an “explanation”, candidates have only mentioned in brief, the criteria which are required to be fulfilled for Particular and General Average applicability. The answers in general do not indicate that there is a clear understanding of what these terminologies signify. Besides, even here, a very large number of candidates did not seem to understand, what is Particular Average, other than merely saying it is a partial loss.

Also, in response to “Under what circumstances a General Average (GA) can be declared”, only the criteria to be fulfilled to qualify as GA, have only been repeated. This will obviously not earn much credit.

Strangely, even though this is a familiar topic, the basic role of average adjusters had not been explained with any clarity.

6A

Evaluation of Green Ammonia as a zero-carbon marine fuel

The Pros

- Zero CO₂ and SO_x emission risk (well-to-wake basis). From the regulatory point of view, it is able to avoid carbon taxes and penalties, effectively improving vessel CII ratings.
- It is obtainable by combining green hydrogen (i.e. it is obtained by electrolysis, using renewable electricity) and nitrogen separated from air.

Note: Renewable electricity: electricity generated from energy sources that are naturally replenished and do not depend on consuming fossil fuels. The main sources are solar, wind, hydroelectric, tidal / wave or geothermal energy. In other words, the electricity used must itself be generated with little or no greenhouse-gas emissions. Therefore, if that electricity was produced by using coal-fired boilers, that ammonia can not be strictly taken as green ammonia, even if it contains no carbon.

- Has a reasonably established global manufacturing, storage, and transport network.
- Has lower flammability risks compared to alternative gas or liquid fuels like LNG or Methanol.
- Scalability: the production can easily expand to meet the demands of global shipping, fundamentally because its raw necessary inputs like water, air and renewable electricity, are unlimited.

The Cons

- Highly toxic, thereby hazardous to human health if inhaled or touched;
- Accidental spills can severely affect marine ecosystems instantly
- Improper combustion can lead to the release of N₂O, a greenhouse gas which is 300 times more potent (i.e. in warming the atmosphere, since its chemical structure makes it efficient at absorbing the earth’s thermal infrared radiation) than CO₂.

- It has a high “atmospheric longevity”, i.e. if N_2O is released by the engine, it persists in the lower atmosphere for about 110 to 114 years without breaking down. This N_2O is also the most significant ozone depleting substance being emitted.

Challenges related to safety High toxicity to humans; even exposure as low as 50 ppm severely irritates the eyes and the respiratory system. Above 300 ppm, can cause fatal lung damage

- ✓ If it leaks and mixes with the humid sea air, it may form a toxic, heavy dense cloud. This cloud clings to the ship’s deck, trapping crew members in danger zones.
- ✓ It has to be handled as a liquid either at -33 degrees Celsius or under intense pressure. Any HP hose bursting can cause the formation of a vapour cloud
- ✓ It presents a serious explosion risk if trapped in enclosed spaces like engine rooms. A BLEVE can also be led to, if a pressurized ammonia storage tank is subjected to an external fire, leading to
- ✓ rupturing the hull.

Challenges related to storage

- Low volumetric energy density requires 3 to 4 times the storage volume as compared to traditional Heavy Fuel Oil, for the same sailing requirements. This requires enormous fuel tanks, eating into cargo carrying capacity;
- The need to store in liquid form, necessitates the use of either a fully refrigerated system to maintain the ammonia at -33 degrees Celsius (i.e. cryogenic), which is highly power-intensive, or, in a fully pressurized state, at about 10 to 18 bars, at ambient temperatures, which requires thick-walled, spherical Type-C steel tanks (or membrane tanks, fully integrated in the ship’s hull-structure, with thermal insulation).
- Materials like copper, brass or other shipboard alloys are subjected to aggressive corrosion. Carbon-manganese steels are prone to Stress-Corrosion-Cracking. This requires the use of expensive stainless steel or specialized coatings, in tanks.
- Unlike conventional fuels which can be stored in the ship’s double bottom, Codes like the IGC, stipulate that ammonia tanks are to be positioned well in-board (i.e. damage protection, against hull breach or collision) from the ship’s side.
- Unlike other gases, ammonia simply cannot simply be vented into the open sea atmosphere, due to its toxicity. Dedicated re-liquefaction plants or combustion units are required to be installed, to burn-off the excess vapour safely.

Challenges related to combustion

- Has a high auto-ignition temperature, i.e. 650 degrees Celsius, to self ignite. So the fuel is chemically stubborn. Normal heat produced by compression as in marine diesel engines, cannot generate enough heat to ignite the ammonia. So, a dual-fuel system is necessary, i.e. a highly reactive pilot-fuel (e.g. diesel or MGO), must be injected into the cylinder first, which will provoke the initial ignition.
- During starting or idling or maneuvering loads on the engine, the cylinder temperatures could be much cooler. These temperatures may not be adequate to overcome the high auto-ignition temperatures of the ammonia, inviting misfires. Such misfiring, may lead to unburnt, highly toxic ammonia gas to be released into the ship’s exhaust system.

Challenges related to safety, storage & combustion of Ammonia in marine ICE versus fuel cells.

For the purpose of this answer, the Proton Exchange Membrane Fuel Cell(PEMFC) is being considered, since these are currently being used for marine purposes, although for short trips.

The other cells are yet to be used widely. The PEMFC generates electricity by electrochemically combining hydrogen and oxygen, rather than by burning hydrogen.

Storage: Ammonia has a good bit of advantage. Hydrogen is a light molecule and it is difficult to store in large quantities, since it generally requires either high-pressure tanks or liquefaction at about -253 degrees Celsius. Both the options impose substantial costs by way of tank volume / construction, insulation and ship design. Liquid ammonia on the contrary, can be stored either in a refrigerated at about -33 degrees Celsius (at atmospheric pressure), or, under moderate pressure at ambient temperatures.

"Volumetric practicality" (i.e. it means how practical a fuel is in terms of the amount of the volume it occupies on board the ship, to provide a given amount of useful energy. This is important since tank volume is not much affordable), is poorer as applicable to the storing of hydrogen for PEMFC, whereas, it is better for green ammonia. The suitability for long-voyages using the hydrogen for PEMFC is quite challenging as compared to green ammonia.

Safety: There is quite a contrast between the nature of danger as applicable to hydrogen for PEMFC vis-à-vis that of ammonia. Hydrogen is non-toxic whereas ammonia is badly toxic and corrosive. However, it leaks very easily because of its light molecular size, has a wide flammability range, ignites readily and can create serious fire / explosion hazards. Ammonia is capable of creating a major hazard during leakage or bunkering. Therefore, ammonia-fueled vessels require double barriers (i.e. a single failure or leak cannot allow the toxic ammonia to escape directly into an area where living beings may be exposed), leak detection, ventilation, gas-tight systems, emergency arrangements and rigorous training for the crew handling it.

Hydrogen for PEMFC has a very wide flammability-range in air, i.e. around 4% to 75% by volume. Therefore, a hydrogen leak has quite a few concentration-combinations, at which it can become ignitable.

Combustion: Ammonia has a relatively low flame-speed and poor ignition qualities. High-temperature combustion can produce NO_x, besides the possibility of emitting unburned ammonia, commonly known as "ammonia slip". Therefore, although ammonia contains no carbon and produces no CO₂ from combustion, an ammonia engine is not pollution-free, as such. The PEMFC, on the other hand does not burn hydrogen. It converts it electrochemically and therefore eliminates combustion-related NO_x and particulate emissions. This is a major environmental advantage of the fuel cell.

Ammonia is difficult to ignite and burns relatively slowly. Therefore, in contemporary marine engines, ammonia may require a small quantity of pilot-fuel (Diesel or MGO, usually) or another ignition-assistance system. That is why ammonia engines are often called dual-fuel engines.

The hydrogen for PEMFC, has a combustion advantage, on account of its wide flammability range, can sustain combustion over a wider range of fuel-air mixtures. This makes it easier to achieve stable combustion under varying mixture conditions.

6B

Candidates who attempted this question did not go wrong on the elementary issue of toxicity of ammonia. But, the vast majority of the candidates hardly mentioned the multiple issues related to storage, safety and combustion of ammonia. Very few candidates wrote about the conflicting requirements related to fuel cells. Even those candidates who did, neither mentioned what kind of fuel cell they were considering for the answer, nor did they state the many important issues related to hydrogen for PEMFC, other than the factor of explosivity, in some cases.

7A

Significance of the M.S Act 2025:

Fundamentally, refurbishing India from being basically a major seafarer-supplying and cargo-

trading nation to becoming a stronger ship-owning, ship-registering and an important entity to render maritime services. It liberalizes ship-owning to now include non-resident Indians, overseas citizens of India, decriminalizes minor offenses, integrates IMO Conventions and introduces digital registration, in effect encouraging trade, tonnage expansion and foreign investment.

Trade & Tonnage Expansion:

- (i) Relaxed Ship-owning rules – in addition to the existing domestic citizens, it now incorporates, NRIs, OCIs and facilitating diverse capital into the Indian maritime registry;
- (ii) Bareboat Charter Registration – allows Indian set-ups to register foreign vessels under the bareboat-charter-cum-demise (BBCD) contracts, scaling up the operational fleet flying the Indian flag. The Act intends to make it easier for an Indian company to control, finance, and ultimately own ships under the Indian maritime framework.
- (iii) Introducing a more comprehensive registration regime covering virtually all categories of seagoing vessels
- (iv) Allowing for more flexible registration procedures.
- (v) Increased tonnage contributes to India's trade, by way of saving the billions being paid annually to foreign shipping companies for moving the cargo which Indian ships could have, in effect, conserving these freight payments within the Indian economy, and, allows the domestic shipping lines to earn foreign currency by carrying cargo for other nations. Besides, this also helps to guard against supply chain disruptions during regional conflicts; guarantees to a large extent energy-security (crude oil & gas imports) and largely-ensures the stability of freight rates.
- (vi) Over and above, allied sectors related to seafarer employment (including training), shipbuilding / ship repairing / ship recycling; ship management, marine insurance; ship financing and maritime legal services, ports and logistics would all gain by way of a multiplier effect.

Attracting Foreign Investment

With easier digitalized on-line registration procedures with standardized check-lists and timelines, the prospective owner is assured that he would start earning freight rather promptly. Better and easier prospects of ship financing (with a robust framework for recording mortgages / encumbrances), makes the ship readily usable as collateral for institutional ship finance.

Wider ownership participation as explained above, may have the potential for joint ventures (assuming that the regulatory conditions permit such a structure), enabling foreign equity capital to participate in Indian shipping ventures, while potentially retaining Indian-flag status. The Act can facilitate the use of foreign equity capital into Indian shipping companies, by making the ownership structure of Indian-registered vessels more flexible, subject to the foreign investment and ownership conditions.

Enhance maritime standing, aligning with global best practices

The Act is now aligned to enable India meeting its obligations under international maritime conventions and incorporates updated provisions related to, SOLAS, MARPOL, STCW, MLC, MARITIME SECURITY, WRECK & SALVAGE, LOAD LINE REQUIREMENTS, SHIP RECYCLING, POLLUTION RESPONSE & FLAG / PORT STATE RESPONSIBILITIES.

The country's flag administration is judged internationally by the quality of its survey /

certification, safety enforcement, casualty investigations, pollution controls, seafarer training & assessment standards & PSC performances. If India gets to be recognized as a credible, efficient and contemporarily compliant flag state, Indian-flag ships ought to become more readily acceptable to charterers, cargo interests, banks, insurers, classification societies & international ports.

Conclusion

While the above are really important, the Act itself will not automatically cause the Indian tonnage or foreign investments to rise. This legislation only and though importantly, creates the enabling environment, the economics related to the vital factors such as vessel acquisition costs, cost of financing, operating costs (including fuel costs), taxes, port and canal charges, freight earnings / cargo availability; exchange rates etc. will largely take a call on whether it would make business sense financially and commercially (i.e. the returns expected) for investors to get really attracted to invest in Indian shipping and make it grow.

7B

This question requires a thorough study of the financial / commercial issues mentioned above, against a clear concept of what is contained in the M.S. Act 2025. Over and above, all this has to be expressed concisely and correctly, which requires a good command of the language. In case all these factors are not properly integrated, the answer will not get the desired credit. This is what has happened with almost every candidate who attempted this question.

8A

Explanation of the difference between “crew competence” and “crew performance” are: Crew competence is that which a seafarer knows (i.e. are they technically and legally capable of doing a job) what and how to perform a task / discharge a responsibility on board, whereas, “crew performance” is what and how the seafarer actually does (safely & correctly) during daily shipboard operations. In other words, crew competence is the theoretical / practical knowledge, qualifications and skills a seafarer possesses, whereas, crew performance is the observable actions, behaviour and efficiency of the crew while executing real-time tasks. Crew competence is measurable by way of a seafarer possessing STCW certificates, training logs and simulator assessments. Crew performance is quantifiable by onboard observations, response times during drills, safety records and vetting inspections.

Training and drills help in translating the theoretical knowledge the seafarer has, into effective and automatic, physical / hands-on performance, more so under high-stress conditions, as usually faced during emergencies. As is well known, panic arising out of shipboard emergencies, leads to “cognitive overload” (i.e. the volume of information / intensity of mental tasks needed to be performed, exceeds the seafarer’s capacity of his brain to be able to process the needful).

Regular training by simulating a highly realistic emergency that closely replicates actual conditions at sea, helps in effectively combating the emergency. Instead of just talking through a check-list or pretending to do an action, seafarers are immersed in a high-pressure environment where equipment, physical surrounding and timing match a real-time crisis. Such training and drills help in building “muscle memory” (being able to perform a task involuntarily and correctly, without having to consciously think about it) and “psychological readiness” (mental and emotional readiness to face a sudden, high-stress crisis without panicking, freezing, or breaking down, so that control of the mind is maintained) ensuring that the seafarer executes safety – procedures flawlessly when lives are at stake. Besides, repetitive drills / training contributes a great deal towards error-free execution of required tasks.

Some Positive effects of advanced technology and automation on the Human Element in shipping:

- (i) Reduction of human error (e.g. automated collision avoidance systems, help in avoiding risks caused by fatigue, poor visibility, miscalculation etc.)

- (ii) Enhanced environmental efficiency (AI-driven weather routing & real-time fuel-injection optimization help vessels lower their fuel consumption, ultimately improving their CII)
- (iii) Reduced cognitive loads in routine tasks (automated data logging, cargo monitoring and machinery tracking help in reducing fatigue)
- (iv) Performing condition-based maintenance (sensor networks monitor machinery vibration, temperature, and wear in real time, allowing engineers to address faults before a breakdown occurs)
- (v) Improved life safety (automated systems or drones / advanced robotic vessels, for high-risk operations such as inspecting cargo holds, tank cleaning, measuring hazardous gases, carrying out underwear inspections, can be done much more safely).

Some Negative effects of advanced technology and automation on the Human Element in shipping:

- (i) Cyber security vulnerabilities: bridge and engine systems are prone to inviting malware, ransomware, spoofing (the ship's GPS receiver is tricked into believing it is located somewhere it is not. It manipulates the ship's calculated position, navigation and timing data, without triggering immediate system alarms).
- (ii) Over-reliance on digital tools like ECDIS and ARPA etc. cause seafarers to lose basic, manual seamanship skills, such as celestial navigation, paper charting, and visual lookout practices. This is called automation bias.
- (iii) When automated systems run flawlessly for long periods, watchkeepers can become much less alert. Then when a system suddenly fails, the crew faces a massive cognitive overload, as they struggle to manually figure out what went wrong.
- (iv) Automation downsizes crew complements to the minimum safe manning levels, individual seafarers face increased social isolation, longer work shifts, and a higher risk of psychological burnout.

8B

- (I) Strangely, a large number of candidates have written long paragraphs on explaining Human Element, which was not asked for in the question and therefore not only the candidate has wasted his time, no credit can be given by the examiner.
- (II) Difference between "crew competence" and "crew performance" has been asked for in the question. A very large number of candidates have separately mentioned, what is meant by "crew competence" and "crew performance". Had the question asked, "please explain what is meant by, (a) Crew competence; & (b) Crew performance, such an answer was acceptable. But that was not the question. Over and above, in a good many cases, even these are vaguely or incorrectly explained. Therefore, effectively, the question not having been answered, very little credit can be given to the answer.
- (III) The answers relating to the positive and negative effects of advanced technology and automation on the Human Element in shipping, have been more or less approached correctly, even though it cannot be said that these have been adequately answered in a manner which entitles the answer to good credit.

9A

Uberrimae fidei – means, “of the utmost good faith”. Both, the insurer and more importantly the assured, must disclose the material facts honestly and fully to the insurer.

Material facts – information / circumstances that would influence the insurer’s decision to accept the risk, determine the premium or impose particular conditions.

Examples of disclosures which must be made by the insured to the insurer in a marine insurance – nature of cargo(hazards from chemical composition / flammability, packing methods, special conditions of carriage); unusual shipping routes(prone to bad weather or piracy attacks) and trading limits / chances of going to war-zones; age and overall condition of the vessel(s); previous history of detentions / releases / near-misses / groundings / other maritime losses; suspension or withdrawal of Classification Certificate; CII ratings; records of the OCIMF SIRE 2.0 inspection, Internal Vetting records(an internal risk assessment performed by an oil major’s own marine assurance team); CDI-M(focusing on inspection of Chemical Tankers & LPG ships) and RightShip (primarily vets and inspects Dry Cargo Vessels) inspection records(helps in Granular Risk Profiling) ; crew competency indicators; track record with respect to how professional is the ownership and/or management structure; instances where previous marine insurers may have refused renewal, cancelled a policy, or increased premiums due to high risk.

Examples of disclosures to be made when the policy remains valid – major material alterations in say hull, machinery; change of flag or to another management company; deviation from the standard, agreed-upon geographical route, without a lawful excuse.

Note: The question does not restrict the disclosures to any specific stage.

List of the circumstances which need not be disclosed to the insurer – (i)circumstances that reduce the risk, i.e. any fact that actually reduces the likelihood or severity of a loss; (ii)circumstances / facts that the insurer already knows or is legally presumed to know by virtue of their regular case of business; (iii) circumstances waived by the insurer, explicitly or implicitly; (iv)Circumstances covered by an Express or Implied Warranty.

What happens to the marine insurance contract if the disclosures are not made to the insurer at the time of conclusion of the contract - The contract becomes voidable (as if it never existed), at the discretion of the insurer, even if the undisclosed fact had nothing whatsoever to do with the actual cause of the loss. However, usually, if the non-disclosure was innocent (i.e. not with a fraudulent motive), the premium paid is returned. The local jurisdiction rules prevail.

9B

This question was largely answered correctly by the majority of candidates, except that whereas an “explanation” was sought, only a single line was mentioned. The list of disclosures was of course stated inadequately by virtually all the candidates. A good number of candidates found it important to disclose items such as vessel’s particulars, which though necessary are of lesser importance as compared to information on, say, trading sea-areas or whether the Class was withdrawn or vessel was involved in incidents arising out of questionable quality manning. Disclosures required to be made when the policy remains valid, was not mentioned by any candidate.

List of the circumstances which need not be disclosed to the insurer, was hardly mentioned correctly and adequately by any candidate.