1. False Echoes on Radar?
   - **Multiple Echoes** occur when a short range, strong echo is received from a ship, bridge, or breakwater. A second, a third or more echoes may be observed on the display at double, triple or other multiples of the actual range of the target. Multiple reflection echoes can be reduced and often removed by decreasing the sensitivity or properly adjusting the A/C Sea.

   - **Side-lobe Echoes**: Every time the antenna rotates, some radiation escapes on each side of the beam - called “side-lobes.” If a target exists where it can be detected by the side-lobes as well as the main-lobe, the side-lobe echoes may be represented on both sides of the true echo at the same range. Side-lobes show usually only at a short ranges and from strong targets. They can be reduced through careful reduction of the sensitivity or proper adjustment of the A/C Sea.

   - **Indirect Echoes** may be returned from either a passing ship or returned from a reflecting surface on your own ship, for example, a funnel or mast etc. In both cases, the echo will return from a legitimate contact to the antenna by the same indirect path. The echo will appear on the same bearing of the reflected surface, but at the same range as the direct echo. Indirect echoes may be recognized as follows:
     a. they usually occur in a shadow sector
     b. they appear on the bearing of the obstruction but at the range of the legitimate contact
     c. when plotted, their movements are usually abnormal, and
     d. their shapes may indicate they are not direct echoes.

   - **Blind and Shadow Sectors**: Funnel, stacks, masts, or derricks in the path of antenna may reduce the intensity of the radar beam. If the angle subtended at the antenna is more that a few degrees a blind sector may be produced. Within the blind sector small target may not be detected while larger targets at much greater ranges may be detected.

2. ARPA? Lost Target?
   - **Automatic Radar Plotting Aids** is one of the instruments effective for aiding safe navigation in term of collision avoidance, and ARPA information is calculated using a target's position (ARPA position), own ship’s course and speed. The ARPA information are well utilised and highly appreciated among watch officers especially when the visibility is limited. However, we should remember that the ARPA system is not complete yet. It still suffers transfer of targets. Here, ARPA information is based on the past ARPA positions from a radar echo signal. So it remains necessary to study on the accuracy of the ARPA information.

   - **Lost targets** happen in case of low sensitivity of radars or bad weather condition or overlapping of two targets etc.

3. GPS (Global Positioning System)?
   (1) The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.

   (2) Fundamentals: The GPS system concept is based on time. The satellites carry very stable atomic clocks that are synchronized to each other and to ground clocks. Any drift from true time maintained on the ground is corrected daily. Likewise, the satellite locations are monitored precisely. GPS receivers have clocks as well—however, they are not synchronized with true time, and are less stable. GPS satellites continuously transmit their
current time and position. A GPS receiver monitors multiple satellites and solves equations to determine the exact position of the receiver and its deviation from true time. At a minimum, four satellites must be in view of the receiver for it to compute four unknown quantities (three position coordinates and clock deviation from satellite time).

(3) Accuracy
- Standard accuracy of about 15 meters with GPS can be augmented to 3-5 meters with DGPS.

(4) How many satellites are necessary to obtain GPS Fix?
- At a minimum four satellites

(5) How many satellites are operating for the GPS system?
- 24 Satellites (4 satellites in each of 6 orbits)

4. Turning Circle

(1) Definition
- A ship’s turning circle is the path followed by the ship’s pivot point when making a 360º turn.

(2) Element
- **Pivot Point**: is a point on the centreline about which the ship turns when the rudder is put over. The pivot point scribes the ship’s turning circle. A ship’s pivot point is nearly located about one-third the ship’s length from her bow when moving ahead, and at or near her stern when moving astern. The location of the pivot point will vary with ship’s speed. An increase in speed will shift the pivot point in the direction of the ship’s movement.

- **Turning Circle**: is the path followed by the ship’s pivot point when making a 360 degree turn. The diameter of the turning circle varies with rudder angle and speed. With constant rudder angle, an increase in speed results in an increased turning circle. Very low speed (those approaching bare steerageway) also increases the turning circle because of reduced rudder effect.

- **Advance**: is the amount of distance run on the original course until the ship steadies on the new course. Advance is measured from the point where the rudder is first put over.

- **Transfer**: is the amount of distance gained towards the new course.

- **Tactical Diameter**: is the distance gained to the left or right of the original course after a turn of 180 degree is completed.

- **Final Diameter**: is the distance perpendicular to the original course measured from the 180º point through 360 degree. If the ship continued to turn at the same speed and rudder indefinitely, it would turn on this circle. The final diameter is almost always less than the tactical diameter.

5. Rolling Period Formula?

\[ T = \frac{C \cdot B}{\sqrt{GM}} \]

- C: Const (0.44 for ft or 0.8 for m)
- B: Breadth
- T: Rolling Period

Ex) GM=1m, B=20m ==> T=?
T = 0.8 x 20 / 1 = 16 seconds (Tender Ship) <not Stiff Ship>
6. What is formula for GM referring to rolling period?

\[ GM = \left( \frac{C \times B}{T} \right)^2 \]

C: Const (0.44 for ft or 0.8 for m)
B: Breadth
T: Rolling Period

7. What is formula for FOC?

\[ F = C \times D^{\frac{2}{3}} \times V^3 \]

F: FO Consumption per day
C: FO Const
D: Displacement
V: Ship’s Speed

8. 500mb Weather Chart? Surface Analysis? Purpose of These Charts?

- The 500mb weather charts consist of geopotential height (solid/straight line) and temperature (dashed/dotted line). The maps show the predominant tropospheric waves (trough or ridge). They virtually control the “weather” (dry, warm/wet, cold) and the long waves drive the smaller synoptic waves. Thus, this upper-level chart illustrates the dynamics of our atmosphere.

- 500 hPa (GPDM) and MSLP
  Geopotential height which the US National Weather Service defines as: roughly the height above sea level of a pressure level. For example, if a station reports that the 500mb height at its location is 5600m, it means that the level of the atmosphere over that station at which the atmospheric pressure is 500mb is 5600 meters above sea level. This is an estimated height based on temperature and pressure data. It is shown by the coloured shading.
  Mean Surface Level Pressure (MSLP) is usually show on the 500hPa GPDM plots with contours.
  The 500hPa plots are useful for a range of reasons, one being that computer models usually forecast this level better than surface conditions at longer ranges.

  In the winter months areas of higher heights (yellow, orange and red shading) to the north and east of the UK are often associated with colder weather. Lower heights to the north and east often mean a typical westerly flow bringing mild or close to average temperatures and unsettled weather.

  In the summer months higher heights over the UK are an indicator of drier and probably warmer weather.

  500hPa ridge - trough patterns can be identified on these charts. Rain is more likely under a trough and dry weather under a ridge.

  Sample
  MSLP and 500hPa charts are available using different map projections and covering different areas. This one below covers the North Atlantic region and Europe. The thick black line shows the 552hPa geopotential height and is shown to make it easy to identify the trough - ridge patterns. This chart shows surface level high pressure areas and upper level ridges to the south of the UK. Areas of lower pressure are to the north. That usually indicates unsettled conditions with temperatures close to the average in the winter months.

  - A surface weather analysis is a special type of weather map that provides a view of weather elements over a geographical area at a specified time based on information from ground-based weather stations. Weather maps are created by plotting or tracing the values of
relevant quantities such as sea level pressure, temperature, and cloud cover onto a geographical map to help find synoptic scale features such as weather fronts. The surface weather charts help us to be able to understand present weather condition at various areas.

- Uraga Suido: not more than 12 knots
- Naka-no Se: not more than 12 knots
- Irago Suido: not more than 12 knots
- Akashi Kaikyo: no speed restriction
- Bisan Seto East: not more than 12 knots
- Uko East: no speed restriction
- Uko West: no speed restriction
- Bisan Seto North: not more than 12 knots
- Bisan Seto South: not more than 12 knots
- Mizushima: not more than 12 knots
- Kurushima Kaikyo: not less than 4 knots exceeding the speed of tidal current

For reference
Three Waters in the Maritime Traffic Safety Law
Tokyo Bay, Ise Bay and Seto Inland Sea

10. One Way Traffic Routes in the MTSL
- Naka-no Se: Northward
- Uko East: Northward
- Uko West: Southward
- Bisan Seto North: Westward
- Bisan Seto South: Eastward

11. Definition of a Huge Vessel and Light & Marking by day & night
- Definition: A vessel whose overall length is 200m or more
- By night: An all-round green light flashing at regular intervals at a frequency between 180 and 200 per minutes
- By day: Two black cylindrical shapes placed vertically
12. Lights and Markings of vessels engaged in construction or other similar operations with permission

- By night: Two all-round green lights placed vertically
- By day: A white diamond shape over two red globular shapes placed vertically

13. Lights & Marking of vessels carrying dangerous cargo

- Definition of vessels carrying dangerous cargo
  a. Vessels of 1,000 gross tons or more which are carrying inflammable liquids or liquified gases in bulk.
  b. Vessels of 300 gross tons or more which are carrying 80 tons or more of ammunition or 200 tons or more of organic peroxides
- By night: An all-round red light flashing at regular intervals at a frequency between 120 and 140 per minutes
- By day: Flag “B” under First Substitute
14. **Lights & Markings of vessels engaged in emergency work, such as firefighting operations, rescue of marine accidents, prevention or removal of marine pollution or controlling of crimes**
   - By night: An all-round red light flashing at regular intervals at a frequency between 180 and 200 per minutes
   - By day: A red cone shape

15. **Specified Ports with very busy traffic in the Port Regulation Law (6 ports)**
   - Keihin
   - Nagoya
   - Yokkaichi
   - Hanshin (Osaka & Kobe)
   - Kanmon

16. **Definition of Small Vessels in the Port Regulation Law**
   - Small vessels mean vessels other than miscellaneous vessels, of 500 gross tones or less in Keihin, Nagoya, Yokkaichi, Hanshin; and 300 gross tones or less in Kanmon.

17. **Definition of Miscellaneous Vessels in the Port Regulation Law**
   - Miscellaneous vessels mean launches, barges and small boats or any craft propelled entirely or mainly by oar. These crafts are all small ones or those which navigate mainly inside a port.
     1) They must keep out of the way of other vessels.
     2) They are not required to sail along designated passages when entering, leaving or passing through a port.
     3) They shall not anchor or stay in a place which may unnecessarily obstruct traffic.

18. **Report of entry / departure in the Port Regulation Law**
   - Vessels except Japanese boats with less than 20 gross tons, small boats or other craft propelled wholly or mainly by oar, vessels licensed to navigate only in smooth water areas, passenger ships engaged in regular route services etc. must make reports to the Captain of the Port when they enter or sail from a specified port.
19. Anchorage in the Port Regulation Law

(1) Designation of anchorage
Certain vessels must receive the designation of anchorages from the Captain of the Port at the three ports of Keihin, Hanshin, and Kanmon.

(2) Vessels to be designated her anchorage
Vessels of not less than 500 gross tons (vessels of not less than 300 gross tons in Wakamatsu quarter of Kanmon port) shall be designated her anchorage by the Captain of the Port.

20. Restriction on shifting in the Port Regulation Law
- Vessels other than miscellaneous vessel may not shift from a certain area where they berthed or the anchorage designated by the Captain of the Port unless they are forced to do so.

21. Order to shift berths in the Port Regulation Law
- If the Captain of the Port considers it necessary, in the event of a fire, to shift vessels close to it to safe berth or, in the event of the onset of a typhoon being certain, to evacuate vessels out of the port, he may give orders to such vessels to shift their berths.

22. Use of passages in the Port Regulation Law
- When entering, leaving or passing through a specified port, vessels other than miscellaneous vessels must use passages specified by the regulations.

23. Steering and sailing rules concerning passages in the Port Regulation Law

(1) Obligation to give way to vessels sailing along a passage
A vessel intending to enter a passage from outside or leaving a passage must keep out of the way of another vessel sailing in the passage.

(2) Prohibition of parallel sailing
Passages in port are generally narrow in width and with dense traffic and, hence, sailing in parallel with another vessel in a passage is forbidden.

(3) Rules of keeping right
While this rule is similar to the steering rule in a narrow channel or fairway provided by the Law for Preventing Collision at Sea, as passages in port are narrow, vessels are not required to keep to the right at all times under this law but only when they meet in the passage.

(4) Prohibition of overtaking
Overtaking other vessels in a passage is prohibited because passages in port are generally narrow in width and there is not sufficient space to overtake other vessels safely.

(5) Special steering rules on overtaking
a. A vessel navigation in Tokyo West Passage, Nagoya, Hiroshima and Kanmon Passage may overtake other vessels carefully when all conditions below are met.
   (i) The vessel to be overtaken does not need to take any action to permit safe passing
   (ii) The vessel overtaking another vessel is able to keep out of the way of any other vessel safely.

b. Pursuant to the provision of the preceding paragraph, a power-driven vessel intending to overtake another vessel in the starboard side of the latter shall sound on her whistle or siren one prolonged blast followed by one short blast and a power-driven vessel intending to another vessel in the port side of the latter shall sound one prolonged blast followed by two short blasts.
24. **Steering rule in the vicinity of a breakwater entrance in the Port Regulation Law**
   - An inbound vessel may enter the port only after an outbound vessel inside the breakwater has cleared the area.

25. **Speed restriction in the Port Regulation Law**
   - A vessel is required to proceed in port at such a speed as may not threaten the safety of other vessels.

26. **Steering rule in the vicinity of a projection**
   - A vessel sighting an object such as a breakwater etc. on her starboard side must sail as close to it as practicable and a vessel sighting such an object on her port side must sail, keeping as large a distance from it as practicable.

27. **What flag shall be exhibited for vessels other than small vessels and miscellaneous vessels when they navigate in a specified port of very busy traffic prescribed by the Port Regulation Law?**
   - International Signal Flag “I”

28. **Inert Gas System on Oil Tanker**
   - An oil tanker’s inert gas system is one of the most important parts of its design. Fuel oil itself is very difficult to ignite, but its hydrocarbon vapours are explosive when mixed with air in certain concentrations. The purpose of the system is to create an atmosphere inside tanks in which the hydrocarbon oil vapours cannot burn. Inert gas systems deliver air with an oxygen concentration of less than 5% by volume. As a tank is pumped out, it is filled with inert gas and kept in this safe state until the next cargo is loaded.

29. **IALA Buoyancy System Region A & B**
   - **Difference**
     - **Region A:** Port lateral marks are red and may have a red flashing light
       Starboard lateral marks are green and may have a green flashing light
     - **Region B:** Port lateral marks are green and may have a green flashing light
       Starboard lateral marks are red and may have a red flashing light
   - **Country**
     - **Region A:** Europe, Australia, New Zealand, parts of Africa and most of Asia other than Philippines, Japan and Korea
     - **Region B:** North, Central and South America, Philippines, Japan and Korea
30. Marine Radar

- X Band Radar: 3cm wave length, 10GHz frequency, useful for Short Range, Good Weather
- S Band Radar: 10cm wave length, 3GHz frequency, useful for Long Range, Bad Weather

31. COLREG

(1) Rule 6 Safe Speed
Every vessel shall at all time proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

(2) Rule 34 Manoeuvring and warning signals
(a) When vessels are in sight of one another, a power-driven vessel underway, when manoeuvring as authorised or required by these Rules, shall indicate that manoeuvre by the following signals on her whistle:

- **one short blast** to mean “I am altering my course to starboard”;
- **two short blasts** to mean “I am altering my course to port”;
- **three short blasts** to mean “I am operating astern propulsion”.
- **two prolonged blasts followed by one short blast** to mean “I intend to overtake you on your starboard side”
- **two prolonged blasts followed by two short blasts** to mean “I intend to overtake you on your port side”
- One prolonged, one short, one prolonged and one short blast, in that order: agreement from a vessel to be overtaken.
- When vessels in sight of one another are approaching each other and from any cause either vessel fails to understand the intentions or actions of the other, or is in doubt whether sufficient action is being taken by the other to avoid collision, the vessel in doubt shall immediately indicate such doubt by giving at least five short and rapid blasts on the whistle. Such signal may be supplemented by a light signal of at least five short and rapid flashes.
- A vessel nearing a bend or an area of a channel or fairway where other vessel may be obscured by an intervening obstruction shall sound one prolonged blast. Such signal shall be answered with a prolonged blast by any approaching vessel that may be within hearing around the bend or behind the intervening obstruction.

(3) Rule 35 Sound signals in restricted visibility
(a) A power-driven vessel making way through the water shall sound at intervals of not more than 2 minutes one prolonged blast.

(b) A power-driven vessel underway but stopped and making no way through the water shall sound at intervals of not more than 2 minutes two prolonged blasts in succession with an interval of about 2 seconds between them.

(c) A vessel not under command, a vessel restricted in her ability to manoeuvre, a vessel constrained by her draught, a sailing vessel, a vessel engaged in fishing and a vessel engaged in towing or pushing another vessel shall, instead of the signals prescribed in paragraphs (a) or (b) of this Rule, sound at intervals of not more than 2 minutes three blasts in succession, namely one prolonged blast followed by two short blasts.
(4) Rule 19 Conduct of vessels in restricted visibility  
(a) Rule 19 applies to vessels (not in sight of one another) in or near restricted visibility.  
(b) All ships shall proceed at a safe speed for the condition of visibility (see Rule 6). A power-driven vessel shall have her engine(s) on stand-by for immediate maneuver.  
(c) All ships shall comply with Section I of this Part e.g., Rules 5 (lookout), 6 (safe speed), 7 (risk of collision), 8 (action to avoid collisions), 9 (narrow channels), and 10 (TSS) with due regard for the visibility conditions.  
(d) If another vessel is detected by radar alone, and a close-quarters or collision risk is suspected, a vessel should take early and substantial action to avoid the other, but:  
(i) avoid any turn to port for a vessel detected forward of the beam, except for a vessel being overtaken;  
(ii) avoid any change of course toward a vessel abeam or abaft the beam.  
When the fog signal of another vessel is heard, apparently forward of the beam, a vessel should reduce speed to the minimum at which she can maintain her course, or if necessary stop, and navigate with extreme caution until there is no risk of collision.

(5) Rule 15 Crossing Situation  
- When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other vessel on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.

(6) Rule 16 Action by give-way vessel  
- Every vessel which is directed to keep out of the way of another vessel shall, so far as possible, take early and substantial action to keep well clear.

(7) Rule 17 Action by stand-on vessel  
(a).  
(i) Where one of two vessels is to keep out of the way the other shall keep her course and speed.  
(ii) The latter vessel may however take action to avoid collision by her manoeuvre alone, as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action in compliance with these Rules.  
(b) When, from any cause, the vessel required to keep her course and speed finds herself so close that collision cannot be avoided by the action of the give-way vessel alone, she shall take such action as will best aid to avoid collision.  
(c) A power-driven vessel which takes action in a crossing situation in accordance with subparagraph (a)(ii) of this Rule to avoid collision with another power-driven vessel shall, if the circumstances of the case admit, not alter course to port for a vessel on her own port side.  
(d) This Rule does not relieve the give-way vessel of her obligation to keep out of the way.

(8) Rule 26 Lights for vessels constrained by their draught  
- A vessel constrained by her draught may, in addition to the lights prescribed for power-driven vessels Rule 23, exhibit where they can best be seen three all-round red lights in a vertical line, or a cylinder.

32. Celestial Navigation  
- Ecliptic: The Ecliptic is the apparent path of the Sun on the Celestial Sphere.
- Equinox Points: The Equinox is two points on the Celestial Sphere where the Celestial Equator and Ecliptic intersect.

- Declination at Equinox, Winter Solstice and Summer Solstice
  Equinox: Zero, Winter Solstice: 23.5ºS, Summer Solstice: 23.5ºN

- SHA (Sidereal Hour Angle): The SHA of a body on the Celestial Sphere is its angular distance west of the Vernal Equinox generally measured in degree

- LHA (Local Hour Angle): Angular distance of a celestial body on the Celestial Sphere measured from own position westward.

### 33. Shallow Water Effects (Squat, Bank Cushion, Bank Side Effect)

- **Squat effect**: is the hydrodynamic phenomenon by which a vessel moving quickly through shallow water creates an area of lowered pressure that causes the ship to be closer to the seabed that would otherwise be expected. This phenomenon is caused when water that should normally flow under the hull encounters resistance due to the close proximity of the hull to the seabed. This causes the water to move faster, creating a low-pressure area with lowered water level surface (Bernoulli’s principle). This squat effect results from a combination of (vertical) sinkage and a change of trim that may cause the vessel to dip towards the stern or towards the bow. Squat effect is approximately proportional to the square of the speed of the ship. Thus, by reducing speed by half, the effect is reduced by a factor of four. Squat effect is usually felt more when the depth/draft ratio is less than four or when sailing close to a bank. It can lead to unexpected groundings and handling difficulties.

  - Squat is caused by the interaction of the hull of the ship, the bottom, and the water between. As a ship moves through shallow water, some of the water it displaces rushes under the vessel to rise again at the stern. This causes a venturi effect, decreasing upward pressure on the hull. Squat makes the ship sink deeper in the water than normal and slows the vessel. The faster the ship moves through shallow water, the greater is this effect; groundings on both charted and uncharted shoals and rocks have occurred because of this phenomenon, when at reduced speed the ship could have safely cleared the dangers.
  
  When navigating in shallow water, the navigator must reduce speed to avoid squat. If bow and stern waves nearly perpendicular the direction of travel are noticed, and the vessel slows with no change in shaft speed, squat is occurring. Immediately slow the ship to counter it. Squatting occurs in both charted and uncharted shoals and rocks have occurred because of this phenomenon, when at reduced speed the ship could have safely cleared the dangers.

- **Bank Cushion**: is the effect on a ship approaching a steep underwater bank at an oblique angle. As water is forced into the narrowing gap between the ship’s bow and the shore. It tends to rise or pile up on the landward side, causing the ship to sheer away from the bank.

- **Bank Suction** occurs at the stern of a ship in a narrow channel. Water rushing past the ship on the landward side exerts less force than water on the opposite or open water side. This effect can actually be seen as a difference in draft readings from on side of the vessel to the other, and is similar to the Venturi effect seen in squat. The stern of the ship is forced toward the bank. If the ship gets too close to the bank, it can be forced sideways into it. The same effect occurs between two vessels passing close to each other.
34. Pilot Ladder & Combination Arrangement (IMO)

- When ship's freeboard reads more than 9 meters, pilot ladder is required to be rigged with combination. Distance between the lower platform of accommodation ladder and the sea level should be minimum 5 meters with acc. ladder 45 degree or less slope. Set first spreader at first 5 steps from end and then set it every 9 steps. Pilot ladder width max 40cm, each step distance 31-35cm, manrope 28-32mm, Pilot ladder must extend at least 2 meters above lower platform.

35. Radar Minimum Objects

- Radar minimum range is Furuno/better than 25 meters, JRC/less than 40 meters.

36. If there is an OFF-Course alarm on her auto pilot, what's your action?

(1) Change the autopilot mode to manual steering.
(2) If manual steering is not functional, change the mode to NFU steering.
(3) If NFU steering is not functional, sound the general alarm for the emergency steering.

37. How many types of steering? 4 types

- Manual steering
- Auto steering
- NFU steering
- Emergency steering

38. In case of shallow water, how much does the turning circle change?

- In shallow water, the turning circle can double or triple.

39. Typhoon avoidance in case that you are in the dangerous area

- When you are in the Northern Hemisphere, bring the wind on her starboard bow, hold course and make best speed for escaping from the center of typhoon.
- When you are in the Southern Hemisphere, bring the wind on her port bow, hold course and make best speed for escaping from the center of tropical cyclone.

40. In case that pilot takes wrong decision, what's your action?

- Master has responsibility for ensuring the safety of the vessel at all times despite pilotage. Therefore if a pilot takes a wrong decision, immediately master has to advise him of correct one. If the pilot does not accept master’s advice and vessel is still in danger, master should directly command the vessel for ensuring her safety.
41. Mercator Projection
- The mercator projection is a cylindrical map projection which became the standard map projection for nautical purposes because of its ability to represent rhumb line as straight segments that conserve the angles with the meridians.

42. Name 7 Currents in the North Pacific Ocean as shown on chart
- Kuroshio
- Oyashio
- North Pacific Current (Drift)
- Alaska Current
- California Current
- North Equatorial Current
- Equatorial Counter Current

43. What kind of fog appears near Japan, when Kuroshio meets Oyashio?
- **Advection Fog**: Because the advection fog forms when quite warm, moist and stable air is blown across a cooler surface of water or land.

44. What signal is required to sound when overtaking another vessel in the Maritime Traffic Safety Law?
- **Starboard side** on the other vessel: one prolonged blast followed by one short blast
- **Port side** on the other vessel: one prolonged blast followed by two short blast

45. In which traffic routes should the vessel keep starboard side of the center line?
- **Uraga Suido**
- **Akashi Kaikyo**
- **Bisan Seto East**
Vessels sailing the above traffic routes shall navigate right side of the traffic route from the center line.

46. Uraga Suido What the following flag signals means?
- 1st sub + N + S: When passing through between Buoys No.4, 6 and 8 in Naka-no Se Traffic Route.
- 2nd sub + N + S: When turing right at the Northern end of Naka-no Se Traffic Route.
47. COLREG Rule 18 Responsibilities between vessels
   (a) A power-driven vessel underway shall keep out of the way of:
       (i) a vessel not under command;
       (ii) a vessel restricted in her ability to manoeuvre;
       (iii) a vessel engaged in fishing;
       (iv) a sailing vessel.
   (b) A sailing vessel underway shall keep out of the way of:
       (i) a vessel not under command;
       (ii) a vessel restricted in her ability to manoeuvre;
       (iii) a vessel engaged in fishing;
   (c) A vessel engaged in fishing when underway shall, so far as possible, keep out of the way of:
       (i) a vessel not under command;
       (ii) a vessel restricted in her ability to manoeuvre;

48. COLREG Rule 9 Narrow channels
   (a) A vessel proceeding along the course of a narrow channel or fairway shall keep as near to
       the outer limit of the channel or fairway which lies on her starboard side as is safe and
       practicable.
   (b) A vessel of less than 20 meters in length or a sailing vessel shall not impede the passage of
       a vessel which can safely navigate only within a narrow channel or fairway.
   (c) A vessel engaged in fishing shall not impede the passage of any other vessel navigating
       within a narrow channel or fairway.
   (d) A vessel shall not cross a narrow channel or fairway if such crossing impedes the passage
       of a vessel which can safely navigate only within such channel or fairway. The latter vessel
       may use the sound signal prescribed in Rule 34(d) if in doubt as to the intention of the
       crossing vessel.
   (e)
       (i) In a narrow channel or fairway when overtaking can take place only if the vessel to be
           overtaken has to take action to permit safe passing, the vessel intending to overtake
           shall indicate her intention by sounding the appropriate signal prescribed in Rule 34(d)
           (i). The vessel to be overtaken shall, if in agreement, sound the appropriate signal
           prescribed in Rule 34(d)(ii) and take steps to permit safe passing. If in doubt she may
           sound the signals prescribed in Rule 34(d).
       (ii) This rule does not relieve the overtaking vessel of her obligation under Rule 13.
   (f) A vessel nearing a bend or an area of a narrow channel or fairway where other vessels may
       be obscured by an intervening obstruction shall navigate with particular alertness and
       caution and shall sound the appropriate signal prescribed in Rule 34(e).
   (g) Any vessel shall, if the circumstances of the case admit, avoid anchoring in a narrow
       channel.
49. Under head-on situation who is the give way vessel between vessel not under command and vessel restricted in her ability to manoeuvre?

- Vessel restricted in her ability to manoeuvre

50. Minimum radar visibility? considering effect of atmospheric refraction

\[ D = 2.08(\sqrt{H_{\text{ant}}} + \sqrt{H_{\text{obj}}}) \]

- Hant: Antenna Height in meter
- Hobj: Object Height in meter
- D: Distance in mile

\[ D = 3.86(\sqrt{H_{\text{ant}}} + \sqrt{H_{\text{obj}}}) \]

- Hant: Antenna Height in meter
- Hobj: Object Height in meter
- D: Distance in kilometer

\[ D = 1.32(\sqrt{H_{\text{ant}}} + \sqrt{H_{\text{obj}}}) \]

- Hant: Antenna Height in feet
- Hobj: Object Height in feet
- D: Distance in mile

51. Radar

- Radar is a word derived from “radio detection and ranging”. It is of great practical value to the navigator in the piloting waters. Radars are not only used to locate navigational aids and to perform radar navigation, but they are also used for tracking other vessels in the vicinity so as to avoid risk of collision.

Radar determines distance to an object by measuring the time required for a radio signal to travel from a transmitter to the object and return. Such measurements can be converted into lines of position (LOP’s) comprised of circles with radius equal to the distance to the object. Since marine radars use directional antennae, they can also determine an object’s bearing. However, due to its design, a radar’s bearing measurement is less accurate than its distance measurement. Understanding this concept is crucial to ensuring the optimal employment of the radar for safe navigation.

The basic principle of radar is to determine the range to an object or “target” by measuring the time required for an extremely short pulse of very high radio frequency, transmitted as a radio wave, to travel from a reference source (own ship) to a target and surrounding area. Bearings to the target are determined by the orientation of the antenna at the moment when the reflected echo returns.

- **X Band Radar**: 3cm in wave length, range resolution good, no good in bad weather like squall, rough sea. short scale range good

- **S Band Radar**: 10cm in wave length. useful in bad weather, long scale range good

- **Bearing Resolution**: Bearing resolution is the ability of the radar to display as separate pips the echoes received from two targets which are at the same range and close together. It is proportional to the antenna length and reciprocally proportional to the wave length.

- **Range Resolution**: Range resolution is the ability to display as separate pips the echoes received from two targets which are on the same bearing and close to each other. This is determined by pulse length only.
- **Multiple echo**: The multiple echo occurs when a radar beam bounces back and forth between the ship and a relatively close-in target, i.e. another ship.

- **False echo**: A false echo is a type of false pip that appears on the display where there is actually no target at all. It occurs when a part of the energy is reflected to the antenna from a part of the ship's structure (indirect echo) or if energy from side lobes (in addition to the main lobe of the radar beam) is reflected back by a target (side-lobe effect).

- **Radar shadows**: Radar shadows occur when a large radar target masks another small object positioned behind it or when an object is obscured by the curvature of the Earth.

52. **In ARPA what case you have lost target?**
- False Echo
- Target too far
- Small target in bad weather
- Poor sensitivity

53. **If you have OFF Course Alarm, what action do you have to take?**
- Change helm to manual steering.
- If manual steering is not functional, change it to NFU steering.
- If NFU is not functional, sound a general alarm for the emergency steering.

54. **Single Right Handed Propeller, which side is better to dock?**
- **Port side**
- When using astern engine, vessel will swing to starboard side by moving the stern to port side caused by the transverse thrust.

55. **When barometer falls rapidly, wind direction changes clockwise, where is your position relative to the course of Tropical Storm?**
- Right Side (**Dangerous Semicircle**) in the Northern Hemisphere
- Action: Bring the wind on her starboard bow, hold her course, make good speed and run out of the center of the tropical storm.

56. **Precautions to diesel main engine**
- To avoid the **Critical RPM**.
57. Morse Code

What do you see on the radar screen for Racon “K”?

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58. **Specified Port in the Port Regulation Law** means a port which is capable of accommodating deep draft vessels or a port customarily used by foreign vessel

59. What is **speed restriction in Japanese ports** as per the Port Regulation Law?

- A vessel is required to proceed in port at such a speed as may not threaten the safety of other vessels.

60. What action should be taken when man overboard?

- Anyone who views the person go overboard shouts, “Man Overboard” and should continue to point in the direction of the MOB.
- Immediately throw MOD marker and buoyancy to help the person stay afloat. Throw floatation devices upwind of the MOB, so that they drift toward the man overboard. That includes life jackets, life rings, or floating boat cushions, daytime orange smoke, dye marker, dan buoy with attached life ring, or simply anything that floats.
- Shout words of encouragement, stay calm, and maintain an eye on the MOB as it is very easy to lose sight of someone in the water.
- Hit the MOB button on the GPS or ECDIS if available.
- The master should brief the crew on the recovery procedure and make everyone and make everyone aware of what method will be used to retrieve the MOB.
- If you lose sight of the MOB for more than one minute, issue a mayday call on the VHF. It can always be cancelled if the man overboard is located.
- While in man overboard procedure, have a crew ember prepare a floating line or if a floating line is not available a line with a large loop.
- Once close to the MOB the master will give directions to launch a rescue boat.
- Once the rescue boat close to the MOB, throw a floating line to the MOB and instruct him/her to put the line around his body and under his arms.
- Slowly pull the MOB to the boat making sure that he/she is able to keep their face above water. Do not pull them in too quickly or they could go under.
- Once the MOB is alongside the boat, get them aboard.
- Keep his body dry and warm for preventing from hypothermia.

61. What is the **Equilibrium** (Stable Equilibrium)?
- A vessel is in stable equilibrium if returns to the upright after being inclined. This only occurs if the center of gravity (G) is below the metacenter (M).
62. What is the **Unstable Equilibrium**?

- If the center of gravity (G) of the vessel is above the metacenter (M) the vessel is said to have a negative GM or a negative initial stability. A vessel in this state has a loll, i.e. she floats at an angle from the upright to one side or the other and there is a danger that she may capsize.

![Unstable Equilibrium Diagram](image)

63. What is the Atmospheric Circulation

![Atmospheric Circulation Diagram](image)
64. Seamen's Strike in a port

65. Shadow Range

66. GM Calculation

67. 11 Traffic Routes in the Maritime Traffic Safety Law

68. Speed limit in the above Traffic Routes

69. SQAUT

70. Forbidden Action in the restricted visibility in the COLREG

71. GPS & DGPS Error

72. Cardinal & Lateral Marks (IALA Region A)
Lateral Marks (IALA Region A & B)

Lateral Buoyage IALA ‘A’

- Port Hand Mark: Any Fl R except (2 + 1)
- Starboard Hand Mark: Any Fl G except (2 + 1)
- Preferred Channel is to Starboard: Fl (2 + 1)R
- Preferred Channel is to Port: Fl (2 + 1)G
- Isolated Danger Mark: Fl (2)
- Safe Water Mark: Iso, Oc L Fl 10s or Mo(A)
- Special Marks: Yellow, rhythm not used for white lights
- Emergency Wreck Buoy: Alt Fl Bu Y

Port Hand
- Topmark (if any): Single can.

Starboard Hand
- Topmark (if any): Single cone, point upward.

Preferred Channel to Starboard
- Topmark (if any): Single can.

Preferred Channel to Port
- Topmark (if any): Single cone, point upward.

Lights, when fitted, are composite group flashing Fl (2 + 1).
74. Method for Finding Gyrocompass Error

- Azimuth of the Sun
- Azimuth of the Polaris
- Amplitude of the Sun