2024 January

3. (a) State the purpose of a planned maintenance system. (4)

(b) State THREE parameters on which planned maintenance may be based. (3)

(c) State how an approved planned maintenance system can influence classification society requirements. (3)

jan 2021

29 January 2021

3. (a) State the purpose of a planned maintenance system. (4)

(b) State THREE parameters on which planned maintenance may be based. (3)

(c) State how an approved planned maintenance system can influence classification society requirements. (3)

Planned Maintenance Systems and Classification Societies:

(a) Purpose of a Planned Maintenance System (PMS):

A Planned Maintenance System (PMS) is a proactive approach to maintaining equipment and assets. Its primary purpose is to:

- **Prevent Equipment Failures:** By scheduling regular maintenance tasks, the PMS aims to identify and address potential problems before they escalate into critical failures that can cause downtime, safety hazards, or costly repairs.
- **Optimize Equipment Performance:** Regular maintenance helps ensure equipment operates efficiently and within its designed parameters, leading to increased reliability, availability, and overall lifespan.
- **Reduce Maintenance Costs:** A PMS can help control maintenance costs by preventing major breakdowns and associated repair expenses. Predictive maintenance tasks can also help identify components nearing failure, allowing for cost-effective replacements before a complete breakdown occurs.
- **Improve Safety:** By proactively addressing equipment issues, a PMS can help create a safer working environment by minimizing the risk of accidents due to equipment malfunction.

(b) Parameters for Planned Maintenance:

Planned maintenance tasks can be scheduled based on various parameters, including:

- **Running Hours:** This is a common method for equipment with components that wear out over time. Maintenance is scheduled based on the number of hours the equipment has been operating. For example, engine oil changes might be scheduled every 500 running hours.
- **Operating Calendar:** Certain maintenance tasks might be time-based, regardless of usage. For example, annual inspections or filter replacements might be scheduled based on a calendar timeframe, ensuring preventive maintenance even for infrequently used equipment.

- **Condition Monitoring:** Modern PMS incorporate condition-based maintenance techniques that utilize sensors and data analysis to monitor equipment health. Maintenance tasks are then triggered based on actual equipment condition rather than predetermined intervals. This can optimize maintenance schedules and avoid unnecessary servicing.

(c) Influence of Approved PMS on Classification Societies:

Classification societies, like DNV or Lloyd's Register, are organizations that set standards for ship design, construction, and operation to ensure safety and environmental compliance. An approved Planned Maintenance System can positively influence classification society requirements in a few ways:

- **Reduced Survey Scope:** A well-documented and effectively implemented PMS demonstrates a commitment to proactive maintenance. This can lead to reduced scope during classification society surveys, as there's greater confidence in the vessel's overall condition.
- **Improved Operational Efficiency:** A functioning PMS can contribute to a vessel's operational efficiency by minimizing equipment downtime and ensuring regulatory compliance. This can be viewed favorably by classification societies.
- **Enhanced Safety Culture:** A strong PMS demonstrates a focus on preventative maintenance and safety, which aligns with the goals of classification societies.

Overall, an approved PMS can streamline interactions with classification societies, potentially reducing survey burdens and demonstrating a commitment to safe and reliable vessel operation.

Planned Maintenance Systems: Purpose, Parameters, and Classification Society Influence

(a) Purpose of a Planned Maintenance System (PMS):

A Planned Maintenance System (PMS) is a structured approach to maintaining equipment and machinery. Its primary purpose is to:

- **Prevent breakdowns:** By proactively scheduling maintenance tasks, a PMS aims to identify and address potential problems before they escalate into major failures.
- **Optimize equipment lifespan:** Regular and appropriate maintenance helps extend the operational life of machinery by minimizing wear and tear.
- **Enhance safety:** A well-maintained system reduces the risk of accidents and injuries associated with equipment malfunctions.
- **Improve efficiency:** Proper maintenance ensures equipment operates at optimal performance levels, leading to increased fuel efficiency and reduced emissions.
- **Reduce maintenance costs:** By preventing major breakdowns and extending equipment life, a PMS can help minimize overall maintenance expenditure.

(b) Parameters for Planned Maintenance:

Planned maintenance schedules are typically based on a combination of three key parameters:

1. **Manufacturer's recommendations:** Equipment manufacturers usually provide recommended maintenance intervals for specific components based on their design and expected lifespan.

2. **Operating hours/cycles:** Maintenance tasks are often scheduled based on the accumulated operating hours or number of cycles the equipment has undergone. This ensures critical components are

serviced before they reach their wear limits.

3. **Condition monitoring:** Modern PMS may incorporate data from condition monitoring systems like vibration analysis or oil analysis. This allows for more tailored maintenance schedules based on the actual health and performance of the equipment.

(c) Influence of Approved PMS on Classification Societies:

Classification societies (CS) play a vital role in ensuring vessel safety and regulatory compliance. An approved Planned Maintenance System can positively influence a vessel's classification society requirements in several ways:

- **Demonstrates proactive approach:** A well-documented PMS demonstrates the owner's commitment to preventive maintenance and safety. This can lead to smoother inspections and potentially fewer deficiencies identified by CS surveyors.

- **Aligns with regulations:** Approved PMS are often designed to align with international maritime regulations and CS guidelines. This simplifies compliance efforts and reduces the risk of regulatory violations.

- **Reduces risk of breakdowns:** By minimizing breakdowns and equipment failures, an effective PMS lowers the chance of incidents that might require CS involvement or detain the vessel for repairs.

- **Provides operational data:** Record keeping within the PMS can provide valuable data on equipment performance and maintenance history. This data can be beneficial for CS surveyors in assessing the overall condition of the vessel and its machinery.

In essence, an approved Planned Maintenance System promotes a culture of safety and proactive maintenance, which aligns with the goals of classification societies. This can lead to a more streamlined classification process and contribute to the safe and reliable operation of the vessel.

oct 2020

30 October 2020

2. (a) State THREE reasons for keeping a log. (6)

   (b) State the person responsible for compiling the log. (1)

   (c) State when the log should be compiled and signed. (1)

   (d) Describe the action to be taken should a mistake be made during writing up the log. (2)

Importance and Procedures of Log Keeping:

(a) Three Reasons for Keeping a Log:

- **Record Keeping:** Logs provide a chronological record of events, activities, observations, and decisions made onboard a vessel. This documented history is crucial for:
    - **Future Reference:** It allows for reviewing past events, troubleshooting issues, and identifying trends or patterns.
    - **Regulatory Compliance:** Many maritime regulations require specific information to be recorded in logs, such as safety drills, cargo operations, and navigational activities.
    - **Accident Investigation:** In case of an incident or accident, the logbook serves as a vital source of information to aid in investigation and reconstruction of events.
- **Communication:** Logs facilitate communication and information sharing between crew members on different shifts or departments. Important information about equipment status, maintenance tasks, or navigational observations can be documented and easily accessed by relevant personnel.

- **Accountability:** Log entries create a record of actions taken and decisions made. This promotes accountability and ensures crew members are responsible for their duties and observations.

(b) Person Responsible for Compiling the Log:

The person responsible for compiling the log depends on the specific type of log and the onboard hierarchy:

- **Deck Log:** Typically compiled by the officer on watch (OOW) or a designated deck officer responsible for bridge operations and navigation.

- **Engine Room Log:** Compiled by the engineer on watch (EOOW) or a designated engineer responsible for monitoring engine room operations and equipment status.

- **Cargo Log:** Compiled by the cargo officer or personnel directly involved in cargo handling and loading/unloading operations.

- **General Log:** This log might be maintained by the captain or a designated officer for recording general events, announcements, or crew activities not covered in specific departmental logs.

(c) When to Compile and Sign Log Entries:

Log entries should be compiled and signed as soon as possible after the event, observation, or action being recorded. Ideally:

- **Deck Log:** Entries should be made at the end of each watch period or as events unfold during the watch.
- **Engine Room Log:** Similar to the deck log, entries are ideally made at the end of each watch or as significant events occur.
- **Cargo Log:** Entries are typically made during cargo operations, recording details like cargo type, weight, hatch activity, and any relevant observations.
- **General Log:** Entries are made upon the occurrence of the event or activity being documented.

All log entries should be signed by the person who compiled them, with the date and time noted.

(d) Action for Mistakes in Log Entries:

Mistakes in log entries should be corrected promptly to maintain the integrity of the record. Here's the proper way to handle them:

- **Do Not Erase or Use White-Out:** Never erase or use correction fluid (white-out) on log entries. This can be seen as an attempt to tamper with the record.

- **Draw a Single Line Through the Mistake:** Draw a single horizontal line through the incorrect information. This clearly indicates an error has been made.

- **Write the Correct Information Above:** Write the correct information neatly above the line drawn through the mistake.

- **Initial and Date the Correction:** Initial and date the correction next to the line to indicate who made the change and when.

This method allows for a clear record of the original entry, the correction made, and who is responsible for the change.

jan 2021

29 January 2021

2. With reference to the engine log books, explain the reasons for recording EACH of the following, and the effect on the engine should the temperatures be outside the normal parameters:

   (a) exhaust temperatures; (3)

   (b) cooling water inlet/outlet temperature; (3)

   (c) lubricating oil temperature. (4)

Engine Log Book Entries: Temperature Monitoring

Engine log books record various temperature readings to monitor engine health and performance. Here's a breakdown of why each temperature is recorded and the potential effects if they deviate from normal parameters:

(a) Exhaust Temperatures:

Reason for Recording: Exhaust gas temperature (EGT) is an indicator of engine combustion efficiency.

Effect of Abnormal Temperatures:

- **High EGT:** Can indicate several issues:
  - **Lean Burn:** Insufficient fuel can cause high EGT due to incomplete combustion. This can lead to increased engine wear, reduced power output, and potential exhaust valve damage.
  - **Faulty Injectors:** Clogged or malfunctioning injectors can cause uneven fuel distribution, leading to pockets of high temperature in the cylinders.
  - **Turbocharger Problems:** Issues with the turbocharger, such as restricted airflow or oil leaks, can contribute to high EGT.
- **Low EGT:** Less common, but a low EGT might indicate:

  - **Rich Burn:** Excessive fuel can cause incomplete combustion and lower EGT. This can lead to fuel inefficiency, increased smoke emissions, and potential fouling of spark plugs or injectors.
  - **Coolant System Issues:** A malfunctioning thermostat or coolant leak could cause the engine to run cooler than normal, leading to a lower EGT.

(b) Cooling Water Inlet/Outlet Temperature:

Reason for Recording: These readings monitor the effectiveness of the engine cooling system.

Effect of Abnormal Temperatures:

- **High Outlet Temperature:** Indicates the engine is running hotter than normal. This could be caused by:
  - **Low Coolant Level:** Insufficient coolant circulation due to a leak or low level can lead to overheating.
  - **Blocked Radiator/Heat Exchanger:** Restricted coolant flow due to clogged passages in the radiator or heat exchanger can cause overheating.
  - **Faulty Water Pump:** A malfunctioning water pump can reduce coolant circulation and lead to overheating.
- **Low Outlet Temperature:** Less common, but a low outlet temperature could indicate:
  - **Stuck-Open Thermostat:** A malfunctioning thermostat that remains stuck open allows excessive coolant flow, leading to overcooling and potentially longer engine warm-up times.

(c) Lubricating Oil Temperature:

Reason for Recording: Lubricating oil temperature is crucial for proper engine lubrication.

Effect of Abnormal Temperatures:

- **High Oil Temperature:** Can lead to:
  - **Oil Breakdown:** Excessive heat accelerates oil degradation, reducing its lubricating properties and increasing wear on engine components.
  - **Increased Oil Viscosity:** Hot oil becomes thinner, reducing its ability to provide adequate lubrication.
- **Low Oil Temperature:** Less common, but very cold oil can be:
  - **Too Thick:** Thick oil may not flow properly at startup, leading to increased friction and wear until the oil warms up.

By monitoring these engine temperatures and comparing them to normal operating ranges, engineers can identify potential problems early on. Taking corrective actions can prevent engine damage, maintain optimal performance, and ensure safe and reliable operation.

AUG 2023

2. (a) State, with reasons, where the watch should be handed over on a vessel fitted with a UMS system, where the period of duty is 24 hours. (2)

(b) Outline the responsibility of the duty engineer with respect to EACH of the following:

(i) the Systems Status Board; (3)

(ii) the Oil Record Book; (3)

(iii) the main and auxiliary Machinery Maintenance Record Book. (2)

Handover and Engineer Responsibilities on a UMS Vessel:

(a) Handover Location on a UMS Vessel (24-Hour Duty):

On a vessel equipped with an Unattended Machinery Space (UMS) system and a 24-hour duty period, the ideal handover location **should be at the central control room**. Here's why:

- **Centralized Monitoring:** The central control room provides a centralized overview of all critical engine room parameters and alarms. This allows the oncoming duty engineer to quickly assess the current status of the machinery and identify any potential issues.
- **Information Sharing:** During handover, the outgoing engineer can efficiently communicate important information about recent events, equipment operation, and any ongoing maintenance tasks directly at the central control room. This ensures seamless continuity of watchkeeping duties.
- **Emergency Response:** Familiarity with the central control room layout and alarm systems is crucial. Handovering in this location ensures the oncoming engineer is immediately prepared to respond to any emergencies that might arise during their watch.

While the central control room is preferred, some vessels might have designated handover stations within the engine room itself. However, the key principle remains ensuring the oncoming engineer has full access to necessary information and equipment for effective watchkeeping.

(b) Duty Engineer Responsibilities:

The duty engineer on a UMS vessel has several key responsibilities:

(i) Systems Status Board:

- **Maintaining Accuracy:** The duty engineer is responsible for ensuring the Systems Status Board displays accurate and up-to-date information about the operational status of all critical machinery and auxiliary systems. This typically involves monitoring alarms, parameter readings, and equipment indications and reflecting them on the board.
- **Identifying Issues:** By monitoring the Systems Status Board, the engineer can identify any abnormal readings or developing problems that require further investigation or corrective action.

(ii) Oil Record Book (ORB):

- **Recording Operations:** The duty engineer is responsible for meticulously recording all oil-related operations in the ORB. This includes entries for:
    - Fuel oil bunkering (quantity, type, supplier)
    - Lubricating oil additions and changes
    - Bilge oil and waste oil discharges (with port and authorization details)
    - Any accidental oil spills or leakages
- **Maintaining Compliance:** Accurate and complete ORB records are crucial for demonstrating compliance with MARPOL (International Convention for the Prevention of Pollution from Ships) regulations concerning oil discharges and oily waste management.

(iii) Main and Auxiliary Machinery Maintenance Record Book:

- **Recording Maintenance:** The duty engineer is responsible for recording all maintenance activities performed on the main and auxiliary machinery in the designated record book.
- **Data Recording:** Entries should include details like:
    - Date and time of maintenance
    - Equipment or system worked on
    - Specific task performed (replacement of parts, adjustments, etc.)
    - Spare parts used (if applicable)
    - Initials of the engineer performing the maintenance
- **Future Reference:** These records provide a history of maintenance performed on the machinery, which can be valuable for future reference, troubleshooting issues, and planning preventive maintenance schedules.

jan 2021

June 2021

2. List TEN common log entries, excluding machinery temperatures, pressures and other parameters. (10)

april 2021

April 2021

2. List TEN common log entries, excluding machinery temperatures, pressures and other parameters. (10)

Here are ten common log entries, excluding machinery parameters:

1. **Commencement/Relief of Watch:** "0800hrs: Relieved OOW [Name] on watch. All navigation lights functioning normally. Course [Course in degrees] at [Speed] knots. ETA [Estimated Time of Arrival] for [Port name] unchanged."
2. **Course Alteration:** "1200hrs: Altered course to [New course in degrees] due to [Reason, e.g., approaching traffic, waypoint on route]."

3. **Weather Observation:** "1600hrs: Weather observation: Wind [Direction] [Force on Beaufort scale], visibility [Nautical miles], Sea state [Sea state description]."
4. **Navigation Mark Sighted:** "1800hrs: Sighted [Navigation mark name] abeam to starboard at [Distance] nautical miles."
5. **Cargo Operation Update:** "0000hrs (Next day): Cargo hold No. [Number] hatch closed. Secured for sea."
6. **Safety Drill:** "0900hrs: Abandon ship drill conducted. All crew members mustered at lifeboat stations within [Time] minutes."
7. **Medical Treatment:** "1400hrs: Crew member [Name] reported feeling unwell. Treated for [Minor illness] with [Medication]."
8. **Equipment Malfunction:** "1000hrs: Auto-pilot malfunction detected. Switched to manual steering."
9. **Wildlife Sighting:** "1500hrs: Observed pod of dolphins [Number] off the port bow at approximately [Distance] nautical miles."
10. **Communication Received:** "2000hrs: Received navigational warning regarding [Navigation hazard, e.g., debris field] at position [Coordinates]."

Here are ten common log entries, excluding machinery parameters:

1. **Commencement/Relief of Watch:** "0800hrs: Relieved [Name of Engineer] on watch. All auxiliary machinery running normally. Sea state [Sea state description]."
2. **Commencing/Completing Maintenance:** "1000hrs: Commenced routine maintenance on main engine air filters. Completed at 1100hrs."
3. **Cargo Operation Update:** "1400hrs: Cargo hold No. 2 discharging operations commenced."
4. **Safety Drill:** "1500hrs: Fire drill conducted. All crew members mustered at designated stations within [Time] minutes."
5. **Medical Treatment:** "1600hrs: Crew member [Name] reported feeling unwell. Treated for [Minor illness] with [Medication]."
6. **Equipment Malfunction:** "1800hrs: Auxiliary generator [Number] alarm activated for [Reason, e.g., low oil pressure]. Switched to standby generator."
7. **Navigation Mark Sighted:** "2000hrs: Sighted lighthouse [Name] on bearing [Direction] at approximately [Distance] nautical miles."
8. **Course Alteration:** "0000hrs (Next day): Altered course to [New course in degrees] to avoid approaching traffic."
9. **Weather Observation:** "0400hrs: Weather observation: Wind [Direction] [Force on Beaufort scale], visibility [Nautical miles], Sea state [Sea state description]."
10. **Communication Received:** "0600hrs: Received weather warning regarding [Navigation hazard, e.g., storm] approaching from [Direction] at an estimated distance of [Distance] nautical miles."

March 21

2. With reference to the engine log books, explain the reasons for recording EACH of the following:

(a) running hours; (2)

(b) lubricating oil consumption; (2)

(c) fuel consumption; (2)

(d) salanity or chloride content of the engine jacket cooling water; (2)

(e) water content of lubricating oil. (2)

Engine Log Book Entries: Monitoring Performance and Health

Engine log books record various parameters beyond just temperatures and pressures to provide a comprehensive picture of engine performance and health. Here's why each of these specific entries is important:

(a) Running Hours:

- **Reason for Recording:** Running hours represent the total cumulative time the engine has been operational. This is crucial for:
  - **Scheduled Maintenance:** Many preventive maintenance tasks are based on running hours. Knowing the total operating time allows for timely scheduling of oil changes, filter replacements, and other routine maintenance to prevent excessive wear and tear.
  - **Performance Analysis:** Tracking running hours helps analyze engine performance over time. Increased running hours might be compared with fuel consumption or wear and tear indicators to identify potential efficiency changes or degradation.

(b) Lubricating Oil Consumption:

- **Reason for Recording:** Monitoring lubricating oil consumption helps identify potential problems:
  - **Leaks:** Excessive oil consumption can indicate leaks in the engine lubrication system, such as worn seals or gaskets. Addressing these leaks promptly prevents oil loss and potential environmental damage.
  - **Increased Internal Wear:** In some cases, increased oil consumption might be a sign of increased internal wear within the engine. Tracking oil consumption trends can help identify potential issues early on.

(c) Fuel Consumption:

- **Reason for Recording:** Fuel consumption is a vital indicator of engine efficiency:
  - **Performance Monitoring:** Tracking fuel consumption allows for monitoring engine performance over time. Increased fuel consumption might indicate inefficiency due to factors like improper combustion, dirty air filters, or worn injector nozzles.
  - **Voyage Planning:** Recording fuel consumption data helps with future voyage planning and fuel budgeting. Knowing the average fuel burn rate allows for more accurate fuel calculations for specific routes and operating conditions.

(d) Salinity or Chloride Content of the Engine Jacket Cooling Water:

- **Reason for Recording:** Monitoring salinity or chloride content in the engine jacket cooling water helps detect potential leaks from seawater sources:
  - **Heat Exchanger Leaks:** Sealoil leaks in the heat exchanger can allow saltwater to mix with the engine coolant. This can lead to corrosion damage within the cooling system and engine block. Detecting increased salinity early on allows for prompt repairs and prevents costly damage.

(e) Water Content of Lubricating Oil:

- **Reason for Recording:** Water contamination in lubricating oil can have detrimental effects:
  - **Reduced Lubrication Properties:** Water can dilute the lubricating properties of oil, leading to increased friction and wear on engine components.
  - **Corrosion:** Water can accelerate corrosion within the engine. Monitoring water content allows for early detection and identification of the source of contamination (e.g., condensation, leaks from the cooling system).

By diligently recording and analyzing these log book entries, engineers can gain valuable insights into engine health, performance, and potential problems. This proactive approach allows for preventive maintenance, improved efficiency, and early detection of issues that could lead to costly repairs or breakdowns.

feb 2021

Feb 2021

2. With reference to the engine room log book:

(a) state THREE reasons for keeping such a log book; (6)

(b) state EACH of the following:

(i) the person responsible for its compilation; (1)

(ii) the interval at which it should be written up and signed; (1)

(iii) the procedure to be followed if a correction of entry is required; (1)

(iv) the purpose of recording a general abstract for main and auxiliary engines. (1)

Engine Room Log Book: Importance and Procedures

(a) Three Reasons for Keeping an Engine Room Log Book:

1. **Monitoring and Performance Analysis:** The log book serves as a historical record of engine performance, including parameters like temperatures, pressures, running hours, and fuel consumption. This data allows engineers to:
   - Monitor trends and identify potential issues before they escalate into major problems.
   - Analyze engine performance over time and identify opportunities for efficiency improvements.
2. **Regulatory Compliance:** Many maritime regulations require the recording of specific engine room data in the log book. This includes details like fuel oil bunkering, lubricating oil changes, and machinery maintenance activities. A well-maintained log book demonstrates adherence to regulatory

requirements.

3. **Communication and Handover:** The log book facilitates communication between engineers on different watches. Important information regarding equipment status, recent events, and ongoing maintenance can be documented and readily accessed by personnel taking over the next watch.

(b) Engine Room Log Book Procedures:

(i) Person Responsible: The **engineer on watch (EOOW)** is typically responsible for compiling the engine room log book.

(ii) Writing and Signing: Entries should be made **as soon as possible** after the event, observation, or action being recorded. Ideally: * Entries are made at the **end of each watch period** or as significant events occur during the watch.

(iii) Correction Procedure: Mistakes should be corrected promptly to maintain the integrity of the record. Here's how:

* **Do not erase or use white-out:** This can be seen as an attempt to tamper with the record.
* **Draw a single line through the mistake.**
* **Write the correct information neatly above the line.**
* **Initial and date the correction** next to the line to indicate who made the change and when.

(iv) Purpose of General Abstract: The general abstract for main and auxiliary engines provides a **concise summary of the engine's overall operating condition**. This includes key parameters like:

* Running hours
* Fuel consumption
* Any abnormal events or observations
* Maintenance tasks performed

This summary allows for a quick overview of the engine's performance during a specific timeframe and facilitates handover between engineers on different watches.

sept 2020

Sept 2020

2. (a) State, with reasons, where the watch should be handed over on a vessel fitted with a UMS system, where the period of duty is 24 hours. (2)

(b) Outline the responsibility of the duty engineer with respect to EACH of the following:

(i) the Systems Status Board; (3)

(ii) the Oil Record Book; (3)

(iii) the main and auxiliary Machinery Maintenance Record Book. (2)

Handover and Engineer Responsibilities on a UMS Vessel:

(a) Handover Location on a UMS Vessel (24-Hour Duty):

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- **Centralized Monitoring:** The central control room provides a centralized overview of all critical engine room parameters and alarms. This allows the oncoming duty engineer to quickly assess the current status of the machinery and identify any potential issues.
- **Information Sharing:** During handover, the outgoing engineer can efficiently communicate important information about recent events, equipment operation, and any ongoing maintenance tasks directly at the central control room. This ensures seamless continuity of watchkeeping duties.
- **Emergency Response:** Familiarity with the central control room layout and alarm systems is crucial. Handovering in this location ensures the oncoming engineer is immediately prepared to respond to any emergencies that might arise during their watch.

While the central control room is preferred, some vessels might have designated handover stations within the engine room itself. However, the key principle remains ensuring the oncoming engineer has full access to necessary information and equipment for effective watchkeeping.

(b) Duty Engineer Responsibilities:

The duty engineer on a UMS vessel has several key responsibilities:

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- **Maintaining Accuracy:** The duty engineer is responsible for ensuring the Systems Status Board displays accurate and up-to-date information about the operational status of all critical machinery and auxiliary systems. This typically involves monitoring alarms, parameter readings, and equipment indications and reflecting them on the board.
- **Identifying Issues:** By monitoring the Systems Status Board, the engineer can identify any abnormal readings or developing problems that require further investigation or corrective action.

(ii) Oil Record Book (ORB):

- **Recording Operations:** The duty engineer is responsible for meticulously recording all oil-related operations in the ORB. This includes entries for:
  - Fuel oil bunkering (quantity, type, supplier)
  - Lubricating oil additions and changes
  - Bilge oil and waste oil discharges (with port and authorization details)
  - Any accidental oil spills or leakages
- **Maintaining Compliance:** Accurate and complete ORB records are crucial for demonstrating compliance with MARPOL (International Convention for the Prevention of Pollution from Ships) regulations concerning oil discharges and oily waste management.

(iii) Main and Auxiliary Machinery Maintenance Record Book:

- **Recording Maintenance:** The duty engineer is responsible for recording all maintenance activities performed on the main and auxiliary machinery in the designated record book.

- **Data Recording:** Entries should include details like:
  - Date and time of maintenance

  - Equipment or system worked on
  - Specific task performed (replacement of parts, adjustments, etc.)
  - Spare parts used (if applicable)
  - Initials of the engineer performing the maintenance
- **Future Reference:** These records provide a history of maintenance performed on the machinery, which can be valuable for future reference, troubleshooting issues, and planning preventive maintenance schedules.

oct 2018

Oct 2018

2. Describe the responsibilities of the off-going duty engineer with respect to EACH of the following:

   (a) fuel service tanks; (2)

   (b) oily water separator; (2)

   (c) potable water tanks; (2)

   (d) machinery space defect book; (2)

   (e) main engine sump level. (2)

Off-Going Duty Engineer Responsibilities:

The off-going duty engineer has several handover responsibilities to ensure a smooth transition for the oncoming watch engineer. Here's a breakdown of their duties regarding the specific points mentioned:

(a) Fuel Service Tanks:

- **Level Gauges:** The off-going engineer should verify fuel levels in all designated service tanks using level gauges or sounding methods. This information should be communicated to the oncoming engineer during handover.
- **Quality:** If there are any concerns about fuel quality (e.g., contamination, unusual appearance), the off-going engineer should report them and ensure appropriate actions are documented.

(b) Oily Water Separator (OWS):

- **Operational Status:** The off-going engineer should confirm the OWS is functioning correctly and report any malfunctions or alarms encountered during their watch.
- **Bilge Alarm:** They should ensure the bilge alarm system is functional and no abnormal bilge water accumulation has occurred.
- **Record Keeping:** Any entries related to OWS operation, bilge water discharge, or alarm activations should be documented in the engine room log book before handover.

(c) Potable Water Tanks:

- **Water Levels:** The off-going engineer should check the water levels in all potable water tanks and report any significant changes or concerns about water availability.

- **Quality:** If there are any doubts about the quality of potable water (e.g., taste, odor, discoloration), they should be reported, and further testing might be necessary.

(d) Machinery Space Defect Book:

- **New Defects:** The off-going engineer should record any new machinery defects identified during their watch in the designated defect book. This includes a detailed description of the problem, its location, and any troubleshooting steps taken.
- **Outstanding Defects:** They should highlight any existing machinery defects that remain unaddressed and require further attention from the oncoming engineer or maintenance personnel.

(e) Main Engine Sump Level:

- **Level Check:** The off-going engineer should verify the main engine sump level using the dipstick or sight gauge. This reading should be communicated to the oncoming engineer during handover.
- **Abnormal Levels:** If the sump level is outside the normal operating range (too high or too low), they should report it and ensure the cause is investigated before the oncoming engineer assumes watch.

aug 2020

Aug 2020

2. List FIVE statutory items that the relieving officer shall be informed of by the officer in charge of the engineering watch prior to taking over the engineering watch. (10)

Standing Orders and Special Instructions: This includes informing the relieving officer of any specific instructions or operational limitations set by the Chief Engineer or relevant authorities. These might be related to:

- Engine operation parameters (e.g., speed restrictions, load limitations).
- Equipment usage restrictions due to maintenance or repairs.
- Fuel changeover procedures or any specific fuel quality concerns.

Condition of Machinery and Ongoing Maintenance: The relieving officer should be informed about the current state of the main and auxiliary machinery. This includes:

- Any ongoing maintenance tasks or equipment malfunctions.
- Abnormal readings or alarm activations encountered during the previous watch.
- The overall operational status of critical systems.

Fuel Oil and Lubricating Oil Levels and Quality: Information about fuel and oil levels in service tanks should be communicated. This includes:

- Availability of fuel for continued operation.
- Any concerns about fuel quality (e.g., contamination) requiring further monitoring.
- Levels and condition of lubricating oil in designated sumps.

Fresh Water and Ballast Water Levels: The relieving officer should be informed about the status of water tanks:

- Levels of potable water available for crew consumption.
- Ballast water tank levels and any recent discharge or pumping operations.

Overall Watchkeeping Duties and Handover of Documentation: The off-going engineer should ensure the relieving officer is familiar with their watchkeeping duties and responsibilities. This might involve:

- Handover of any relevant logbooks, checklists, or operational manuals.
- Briefing on alarm systems and emergency procedures.
- Highlighting any specific communication protocols or reporting requirements.

april 2021

April 2021

3. (a) State THREE advantages of using condition monitoring as part of a planned maintenance system. (3)

   (b) State THREE examples of criteria that could be used as a basis for condition based maintenance. (3)

   (c) State FOUR reasons for keeping records of operating criteria and planned maintenance carried out. (4)

Condition Monitoring in Planned Maintenance Systems:

(a) Advantages of Condition Monitoring:

1. **Predictive Maintenance:** Condition monitoring allows for a shift from reactive maintenance (fixing problems after they occur) to predictive maintenance. By monitoring equipment health, potential issues can be identified and addressed before they lead to breakdowns or failures. This reduces downtime, maintenance costs, and the risk of catastrophic equipment failures.

2. **Optimizing Maintenance Schedules:** Condition monitoring data helps determine the optimal timing for maintenance tasks. Instead of servicing equipment based on arbitrary time intervals, maintenance can be performed when actual sensor readings or performance indicators suggest a need for intervention.

3. **Improved Equipment Lifespan:** Early detection and correction of minor problems prevent them from escalating into major issues. This proactive approach promotes better equipment health and extends its operational lifespan.

(b) Criteria for Condition-Based Maintenance:

1. **Vibration Analysis:** Excessive vibration often indicates developing problems like bearing wear, rotor imbalance, or misalignment. Monitoring vibration levels and trends can trigger maintenance actions before breakdowns occur.

2. **Oil Analysis:** Periodic oil sampling and analysis can reveal signs of wear and tear within machinery. The presence of metal particles, excessive water content, or abnormal viscosity can indicate potential

issues requiring investigation.

3. **Temperature Monitoring:** Deviations from normal operating temperatures can point towards malfunctions. Engine coolant temperature, bearing temperatures, or electrical component temperatures can be monitored to identify potential problems like overheating, blocked cooling passages, or increased friction.

(c) Reasons for Keeping Records of Operating Criteria and Maintenance:

1. **Trending and Analysis:** Maintaining historical records of operating data and maintenance performed allows for trend analysis. By studying past trends, engineers can identify potential issues early on and develop preventive maintenance strategies.

2. **Decision-Making:** Records provide valuable information for making informed decisions regarding future maintenance needs and resource allocation. Cost-effectiveness of maintenance strategies can be evaluated based on past data.

3. **Regulatory Compliance:** Many regulations require documented maintenance plans and records to demonstrate adherence to safety and environmental standards. Proper record keeping ensures compliance with relevant regulations.

4. **Knowledge Transfer:** Well-maintained records facilitate knowledge transfer between engineers and maintenance personnel. New crew members can gain insights from past experiences documented in the records, promoting continuity and improved maintenance practices.

aug 2020

Aug 2020

3. With reference to maintenance and maintenance systems:

(a) state SIX reasons for keeping records; (6)

(b) explain the advantages of an approved maintenance system. (4)

Importance of Records and Approved Maintenance Systems:

(a) Six Reasons for Keeping Maintenance Records:

1. **Trending and Analysis:** Maintenance records provide historical data on equipment performance, repairs, and replacements. Analyzing trends in these records allows for:

    - Identifying early signs of equipment degradation.
    - Predicting potential failures before they occur.
    - Optimizing maintenance schedules based on actual equipment needs.
2. **Decision-Making:** Records provide a basis for informed decision-making regarding maintenance strategies and resource allocation. This includes:

    - Evaluating the cost-effectiveness of different maintenance approaches.
    - Prioritizing maintenance tasks based on urgency and potential impact.
    - Budgeting for future maintenance needs.

3. **Regulatory Compliance:** Many maritime regulations require documented maintenance plans and records. These records demonstrate adherence to:
    - Safety standards for machinery operation.
    - Environmental regulations regarding waste disposal and pollution prevention (e.g., used oil management).
4. **Knowledge Transfer:** Well-maintained records facilitate knowledge transfer between engineers and maintenance personnel. They provide:
    - Information on past repairs and solutions for recurring problems.
    - Training opportunities for new crew members on equipment history and maintenance procedures.
    - Documentation of best practices for future reference.
5. **Warranty Claims:** Detailed maintenance records can be crucial when making warranty claims on equipment repairs or replacements. They demonstrate that proper maintenance procedures were followed, potentially strengthening a claim.
6. **Traceability and Accountability:** Records provide a documented history of maintenance actions taken. This allows for:
    - Identifying who performed specific maintenance tasks.
    - Tracing the use of spare parts and materials.
    - Ensuring accountability for equipment care and adherence to maintenance schedules.

(b) Advantages of an Approved Maintenance System (AMS):

An approved maintenance system offers several advantages over informal or ad-hoc maintenance practices:

- **Structured Approach:** An AMS provides a structured framework for planning, scheduling, and executing maintenance tasks. This ensures a systematic and comprehensive approach to equipment upkeep.
- **Improved Reliability:** By following a documented AMS, the likelihood of equipment failures is reduced. Regular inspections, preventive maintenance, and timely replacement of worn-out parts promote reliable equipment operation.
- **Reduced Costs:** An AMS can help optimize maintenance costs through:
    - Prioritizing tasks based on criticality and avoiding unnecessary maintenance.
    - Extending equipment lifespan with preventative measures.
    - Streamlining maintenance processes and improving efficiency.
- **Enhanced Safety:** A well-maintained AMS contributes to a safer working environment by:
    - Identifying potential safety hazards before they lead to accidents.
    - Ensuring equipment is operating within safe parameters.
    - Promoting a culture of preventative maintenance that prioritizes safety.
- **Regulatory Compliance:** Approved AMS often align with relevant maritime regulations and best practices. This simplifies compliance efforts and ensures adherence to safety and environmental standards.

30 October 2020

3. With reference to maintenance systems:

(a) state the purpose of scheduled maintenance; (4)

(b) explain why unscheduled maintenance may be required even if a scheduled maintenance system is in operation; (4)

(c) state why breakdowns should be kept to a minimum. (2)

Importance of Scheduled Maintenance and Minimizing Breakdowns:

(a) Purpose of Scheduled Maintenance:

Scheduled maintenance is a proactive approach to equipment upkeep that involves performing specific maintenance tasks at predetermined intervals. The purpose of scheduled maintenance is to:

- **Prevent Equipment Failures:** By addressing potential problems before they escalate, scheduled maintenance helps avoid breakdowns that could disrupt operations and cause costly downtime.
- **Maximize Equipment Lifespan:** Regular maintenance reduces wear and tear on machinery, extending its operational lifespan and reducing the need for premature replacements.
- **Optimize Performance:** Scheduled maintenance ensures equipment operates efficiently and within optimal parameters. This translates to better fuel consumption, reduced emissions, and improved overall performance.
- **Enhance Safety:** Proactive maintenance identifies and addresses potential safety hazards before they can cause accidents or injuries.

(b) Reasons for Unscheduled Maintenance:

Even with a scheduled maintenance system in place, unscheduled maintenance might still be required for several reasons:

- **Unforeseen Issues:** Equipment can fail due to unexpected events like sudden component failures, accidental damage, or external factors beyond the scope of scheduled maintenance plans.
- **Human Error:** Mistakes during operation or maintenance can lead to equipment problems requiring immediate attention.
- **Rapid Wear and Tear:** In some cases, equipment components might wear out more quickly than anticipated due to heavy usage, extreme operating conditions, or unforeseen circumstances.
- **Deterioration During Operation:** Certain systems and components may degrade over time even with scheduled maintenance, necessitating unscheduled interventions to address performance issues.

(c) Why Minimize Breakdowns:

Breakdowns in machinery should be kept to a minimum for several key reasons:

- **Costly Downtime:** Equipment failures disrupt operations, leading to lost productivity and financial losses. This might include delays in voyages, cargo spoilage, or missed deadlines.
- **Safety Risks:** Breakdowns can create safety hazards for personnel working in the vicinity of malfunctioning equipment.

- **Environmental Impact:** Equipment failures can lead to pollution incidents, such as oil spills or uncontrolled emissions if leaks or malfunctions occur.
- **Increased Repair Costs:** Major breakdowns often require extensive repairs or replacements compared to addressing minor issues through scheduled maintenance. This can significantly increase maintenance costs.
- **Reduced Operational Efficiency:** Equipment operating with undetected problems might be less efficient, leading to increased fuel consumption and higher operating costs over time.

Therefore, minimizing breakdowns through a combination of well-defined scheduled maintenance and proper operating practices is crucial for safe, efficient, and cost-effective vessel operation.

june 2021

June 2021

3. (a) State THREE advantages of using condition monitoring as part of a planned maintenance system. (3)

(b) State THREE examples of criteria that could be used as a basis for condition based maintenance. (3)

(c) State FOUR reasons for keeping records of operating criteria and planned maintenance carried out. (4)

(a) Advantages of Condition Monitoring in Planned Maintenance:

1. **Predictive Maintenance:** Condition monitoring allows for a shift from reactive maintenance (fixing problems after breakdowns) to predictive maintenance. By monitoring equipment health in real-time, potential issues can be identified and addressed before they lead to failures. This minimizes downtime, maintenance costs, and the risk of catastrophic equipment failures.

2. **Optimized Maintenance Schedules:** Condition monitoring data provides valuable insights into equipment health, allowing for more targeted maintenance schedules. Tasks can be prioritized based on actual sensor readings and performance indicators instead of relying solely on arbitrary time intervals. This optimizes resource allocation and ensures maintenance is performed when truly necessary.

3. **Improved Equipment Lifespan:** Early detection and correction of minor problems through condition monitoring prevent them from escalating into major issues. This proactive approach promotes better equipment health and extends the operational lifespan of machinery.

(b) Criteria for Condition-Based Maintenance:

1. **Vibration Analysis:** Excessive vibration often indicates developing problems like bearing wear, rotor imbalance, or misalignment. Monitoring vibration levels and trends can trigger maintenance actions before breakdowns occur.

2. **Oil Analysis:** Periodic oil sampling and analysis can reveal signs of wear and tear within machinery. The presence of metal particles, excessive water content, or abnormal viscosity can indicate potential issues requiring investigation.

3. **Temperature Monitoring:** Deviations from normal operating temperatures can point towards malfunctions. Engine coolant temperature, bearing temperatures, or electrical component temperatures can be monitored to identify potential problems like overheating, blocked cooling passages, or increased friction.

(c) Reasons for Keeping Records of Operating Criteria and Maintenance:

1. **Trending and Analysis:** Maintaining historical records of operating data and maintenance performed allows for trend analysis. By studying past trends in vibration data, oil analysis results, or fuel consumption figures, engineers can identify potential issues early on and develop preventive maintenance strategies.

2. **Decision-Making:** Records provide a data-driven basis for informed decision-making regarding future maintenance needs and resource allocation. This includes:

   - Evaluating the cost-effectiveness of different maintenance approaches.
   - Prioritizing maintenance tasks based on urgency and potential impact.
   - Budgeting for future maintenance requirements based on past trends.
3. **Regulatory Compliance:** Many maritime regulations require documented maintenance plans and records. These records demonstrate adherence to:

   - Safety standards for machinery operation and equipment performance.
   - Environmental regulations regarding waste disposal and pollution prevention (e.g., used oil management practices).
4. **Knowledge Transfer:** Well-maintained records facilitate knowledge transfer between engineers and maintenance personnel. They provide:

   - Information on past repairs and solutions for recurring problems.
   - Training opportunities for new crew members on equipment history, maintenance procedures, and interpreting condition monitoring data.
   - Documentation of best practices for future reference, ensuring continuity and improved maintenance practices across personnel changes.

may 2021

May 2021

2. With reference to unmanned machinery spaces:

   (a) explain why machinery spaces should be visited on a regular basis; (2)

   (b) explain how the human senses are used to monitor conditions in a machinery space; (4)

   (c) outline the procedure to be adopted if a person wishes to enter a machinery space outside normal working hours. (4)

Unmanned Machinery Spaces (UMS): Visits, Monitoring, and Entry Procedures

(a) Reasons for Regular Visits to UMS:

Even though a UMS is designed for autonomous operation, regular visits by qualified personnel are still crucial for several reasons:

- **Safety Checks:** Physical inspections allow for the detection of potential safety hazards that might not be readily apparent through remote monitoring systems. This includes leaks, unusual vibrations, or any signs of overheating.
- **Verification of Equipment Status:** While alarms and sensors provide information, human observation can confirm the actual state of equipment operation. This might involve checking gauges, listening for abnormal noises, or verifying proper functioning of auxiliary systems.
- **Sampling and Analysis:** Certain checks, like oil sampling or testing bilge water content, cannot be effectively performed remotely. These tasks require personnel to be physically present in the UMS to collect samples for analysis.
- **Maintenance Tasks:** While some routine maintenance can be automated, certain tasks still require human intervention. Filters might need changing, components might require adjustments, or minor repairs might be necessary. Regularly scheduled visits allow for these tasks to be carried out.

(b) Using Human Senses to Monitor Conditions in a UMS:

While remote monitoring systems play a vital role, human senses remain valuable tools for monitoring conditions in a UMS during visits:

- **Sight:** Inspecting machinery for leaks, signs of wear and tear, loose components, or smoke can reveal potential problems.
- **Hearing:** Unusual noises, such as grinding, knocking, or excessive vibration sounds, can indicate developing issues with equipment.
- **Touch:** Carefully feeling for excessive heat on components can indicate potential overheating or malfunction. (Caution: prioritize safety and avoid touching hot surfaces directly.)
- **Smell:** Unusual odors, like burning rubber or electrical burning, can be signs of malfunctions or overheating. (Important: prioritize safety and investigate the source cautiously.)

It's important to note that these checks should only be performed by qualified personnel following appropriate safety protocols to minimize risk.

(c) Entering a UMS Outside Normal Working Hours:

Entering a UMS outside normal working hours requires strict adherence to safety procedures to minimize risk:

1. **Obtain Permission:** Authorization from a designated senior officer (Chief Engineer or Officer in Charge of the Watch) is mandatory before entering the UMS outside of normal working hours.
2. **Issue Warning:** Inform the bridge or relevant personnel of the intention to enter the UMS and the estimated duration of the visit.
3. **Double-Check Safety Systems:** Verify that the UMS is in a safe condition for entry. This includes ensuring no alarms are active and all safety systems are functioning properly.
4. **Don Necessary PPE:** Wear appropriate Personal Protective Equipment (PPE) such as safety glasses, gloves, safety boots, and potentially hearing protection depending on expected noise levels.
5. **Work Buddy System:** If possible, work with a partner who can assist in case of emergencies and monitor the situation from outside the UMS if necessary.
6. **Maintain Communication:** Keep the bridge or designated personnel informed of your progress within the UMS and communicate any emerging issues promptly.
7. **Exit Procedures:** Upon completion of the task, ensure the UMS is secure before exiting. Inform the bridge or relevant personnel that you are leaving the UMS.

Following these procedures helps ensure the safety of personnel entering a UMS outside normal working hours and minimizes the risk of accidents or incidents.