IAMI Engineering Knowledge (EK) for an

Engineer Officer of the Watch (EOOW)

Contents

1. Auxiliary Equipment syllabus

The candidate will know the:

Watchkeeping requirements for safe and efficient operation of engine room and auxiliary equipment spaces.

Operation and procedures for ballast, bilge and fuel transfer systems.

Operation of sewage, fresh water production, compressed air, refrigeration systems.

Operation of pumps and heat exchangers.

Importance of the thrust bearing.

Dangers of and procedures for entering enclosed spaces.

Control of level, temperature, pressure.

Operation of and need for centrifugal purifiers.

Starting procedures for lifeboat engines and control of fall of lifeboats.

Operation of centrifugal and positive displacement pumps.

Pollution prevention procedures and equipment.

Fire detection and fire fighting equipment and procedures.

Purpose of legislation and the legislative bodies that enforce the legislation.

Describe watchkeeping activities required for the safe and efficient operation of the vessel. State the procedures for accepting and handing over a watch and requirements for UMS operations. State the documents used explaining their use and importance.

Describe fuel transfer procedures with reference to stability considerations.

Sketch and describe sewage systems, fresh water generators including potable water treatment.

Sketch and describe the operation of oil water separators, explaining their operating principles. State the MARPOL requirements, describe the associated documentation required.

Sketch and describe bilge, bilge injection, ballast systems. Identify problems that may occur and state their causes.

Define an enclosed space, stating the enclosed space entry procedure, explaining the dangers that may be encountered.

Describe the construction of heat exchangers, stating their advantages.

State the importance of the main propulsion thrust bearing, describing its operation and the importance of the oil temperature.

Describe the operation of control air compressors, stating the starting and stopping sequence and the purpose of the safety devices fitted.

Describe the control of systems using two step control, proportional control describing the operation of the transducer.

Describe the basic refrigeration system, referring to the condition of the refrigerant at cardinal points. Diagnose faults from given symptoms, describe the charging and recovery of refrigerant.

Describe the starting and maintenance of lifeboat engines. Explain how the fall of a lifeboat is controlled.

Explain the principle of operation of centrifugal purifiers, including the importance of the correct gravity disc, speed, flow rate, temperature. Differentiate between purifier and clarifier. Explain the consequences of water contamination of fuel and lubricating oil.

Sketch and describe a centrifugal pump, explaining its operating principle, stating possible faults and their causes. Describe priming methods.

Sketch and describe positive displacement pumps, explaining why they need relief valves.

State the checks to be made on the steering gear prior to leaving port.

Describe the procedure for starting and stopping auxiliary engines including first start arrangement.

Describe the pollution prevention procedures, spillage procedures, bunkering procedure.

Describe the construction and operation of portable fire extinguishers. State their identification and placement.

State the classes of Fire and the actions to be taken on discovering a fire. Describe the organisation of fire parties and emergency parties. Describe the testing of CABA.

State the preparations required before operating fixed fire fighting installations. Describe the construction, operation and testing of fire detector heads.

Explain the purpose and use of legislation and legislative organisations; MARPOL, M-Notice types, H&S at work, IMO, SOLAS, ISM, STCW, COSWP,

2. Ship Construction and Electrical section syllabus

The candidate will know the:

Maintenance of and safety requirements for working on electrical equipment.

Protection of generators and distribution systems.

Operation of generators in parallel.

Operation and maintenance of storage batteries.

Conventions and interpretation of electrical circuit diagrams.

The structural components of the vessel and the open deck drainage arrangements.

Effects on stability of transferring fluids within the vessel.

Load line survey.

State the requirements for safe working on electrical equipment, stating the procedure for treatment of electric shock. State the procedure for working near live equipment.

Describe the maintenance required for electrical motors and electrical systems. Explain the cause, detection and prevention of earth faults. Differentiate between earthed and insulated neutral systems.

State the requirements and procedure for paralleling of generators. Explain the consequences of incorrect paralleling and the protection devices fitted.

Describe the switchboard protection devices for protection of generators and distribution system, explaining the need for discrimination.

Differentiate between different types of storage batteries, stating their uses. Describe the maintenance required and the precautions to be taken.

Identify items within a circuit diagram and explain possible effects of faults.

Describe, with sketches, major structural parts of a ship explaining their purpose.

Sketch mid-ship cross sections of standard vessels.

Describe freeing ports and scuppers, explaining their purpose.

Describe the testing for water tightness of doors, hatches and bulkheads.

Explain the load line survey, identifying items included in the survey.

3. Motor section syllabus

The candidate will know the:

Watchkeeping requirements on main propulsion and auxiliary engines.

Safe preparation and shutdown of main propulsion and auxiliary engines.

Starting, stopping and control of main propulsion and auxiliary engines.

Procedures for emergency situations.

Operating principles of two and four stroke engines including turbochargers.

Identification of faults and understand the remedial action required on main propulsion and auxiliary engines.

Operation of ancillary systems for main propulsion and auxiliary machinery.

Operation, control, protection and maintenance of starting air compressors and storage.

Operation, control, protection and maintenance of an auxiliary boiler and feed system.

Describe watchkeeping activities required to maintain operation of main propulsion and auxiliary machinery and associated systems (fuel, lubrication, cooling, air, starting). State the procedures for accepting and handing over a watch and requirements for UMS operations.

Explain the importance of maintaining correct parameters, levels, clearances, lubricating oil condition.

Describe the preparation of propulsion and auxiliary machinery from cold to ready for manoeuvring and shutdown to normal port conditions, explain the reasons for correct warming and cooling down.

Explain starting and reversing of diesel engines and describe the requirements to operate from local, engine side control.

Describe the control of temperatures, pressures, viscosity associated with main propulsion and auxiliary machinery

Explain the causes and dangers arising from scavenge fires, crankcase oil mist, economiser fires, describing their prevention. State how they are detected and the procedure to be taken should they occur.

Identify faults and explain the actions required when given observations and symptoms of main propulsion plant, auxiliary machinery and associated systems. (Fuel, lubrication, cooling, air, starting)

Describe the operating principles of two and four stroke diesel engines including timing diagrams and indicator cards.

Describe the operating principles and explain the purpose of turbochargers.

Identify and explain the function of the constructional components and running gear of diesel engines and turbochargers, describing the routine maintenance required.

Sketch ancillary systems required for operation of main propulsion and auxiliary machinery; cooling water, lubricating oil, high pressure fuel, starting air, fuel oil storage and preparation, identifying the major components and describing the maintenance required.

Describe the manual and automatic operation of starting air compressors. State, and explain the need for, the protection devices fitted.

Identify the fittings of auxiliary boilers and explain their purpose. Describe the testing of level gauges, alarms and safety valves.

Describe and explain the warming procedure for an auxiliary boiler.

State the operating sequence of an automatic burner unit of an auxiliary boiler, explain the need for purging and state the checks and precautions required.

Describe the feed system for an auxiliary boiler; explain the need for, and describe, boiler water tests. Explain the consequences of boiler water contamination.

4. Steam section syllabus

The candidate will know the:

Watchkeeping requirements on boilers, turbines, condensate systems and auxiliary engines.

Safe preparation and shutdown of boilers and turbines and condensate system.

Starting, stopping and control of main propulsion and auxiliary turbines.

Procedures for emergency situations.

Operation and construction of boilers, turbines and gearing.

Identification of faults and understand the remedial action required on boilers, turbines and condensate systems.

Operation and maintenance of the condensate and feed system.

Operation of ancillary systems for boilers, main propulsion and auxiliary machinery.

Operation, control, protection and maintenance of auxiliary engines.

Describe watchkeeping activities required to maintain operation of main propulsion and boilers, auxiliary machinery and associated systems (fuel, lubrication, condensate, cooling, heating). State the procedures for accepting and handing over a watch and requirements for UMS operations.

Explain the importance of maintaining correct parameters, levels, clearances, lubricating oil condition.

Describe the preparation of propulsion and auxiliary machinery from cold to ready for manoeuvring and shutdown to normal port conditions, explain the reasons for correct warming and cooling down.

Explain starting and reversing of turbines and describe the requirements to operate from local control including testing and operation of emergency trips.

Describe the control of temperatures, pressures, levels associated with main propulsion, boilers and auxiliary machinery.

Identify faults and explain the actions required when given observations and symptoms of main propulsion plant, auxiliary machinery and associated systems. (Fuel, lubrication, cooling, condensate, heating)

Sketch ancillary systems required for operation of main propulsion and auxiliary machinery; cooling water, lubricating oil, condensate, fuel oil storage and preparation, heating, identifying the major components and describing the maintenance required.

Describe the construction of boilers, main turbines and condensers.

Describe gearing arrangements, explaining their purpose and faults that may occur.

Describe and explain the warming procedure for a main boiler, stating the requirements for coupling boilers.

Describe the maintenance of main boilers, testing of alarms and safety devices.

Explain the need for, and describe, boiler water tests. Explain the consequences of boiler water contamination.

State the operating sequence of an automatic burner unit of a main boiler, explain the need for purging and state the checks and precautions required.

Describe the component parts of a condensate and feed system for a main boiler and turbine plant.

Describe the operation and maintenance of auxiliary engines, identify faults and explain the need for safety devices.

5. Control Engineering syllabus

The candidate will know:

1. Instruments

- Operation and application of a range of transducers suitable for measuring the following variables: temperature, flow, displacement, velocity, pressure, strain, position, level and light
- Properties of transducers
- Identification of suitable transducers for various control systems

2. Regulators

- Operation of pneumatic and electrical actuators
- Positioners
- Fail safe and fail set
- Identification of suitable actuators for given control systems

3. Control Systems

- On-off control systems
- Block diagram representation of open and closed loop systems
- Continuous control systems
- Logic gates and processes

4. System Diagrams

- Conventions and interpretation of systems drawn to BS1553 and BS1646

The candidate will be able to:

1. Instruments

- Explain the operation and application of transducers suitable for measuring variables from the following list: temperature, flow, displacement, velocity, pressure
- Explain the following properties of a transducer: range, accuracy, repeatability, sensitivity, resolution, linearity, hysteresis
- Identify a suitable transducer for a given control system

2. Regulators

- Describe the operation of pneumatic and electrical actuators
- Explain the use and operation of positioners
- Explain failure modes, giving examples for different systems
- Identify a suitable transducer for a given system

3. Control Systems

- Describe the behaviour of an on-off type of control system and give an example of an application
- Draw a block diagram of a specified closed loop control system consisting of a controller, external input (set point), error detector, error signal, actuator, regulator, manipulated variable, process, controlled variable, feedback loop, transducer and any appropriate signal conditioning devices
- Draw an output/time graph showing the transient and steady state response of a closed loop system in response to a unit step input. The graph should be labelled with steady state error, time to peak, time to settle, overshoot and final value
- Draw labelled graphs showing over damped, under damped, and critically damped behaviour in a closed loop system
- Explain Gain/Proportional band, integral action time, and derivative action time
- Choose the appropriate action and/or actions for given systems
- Draw graphs to show the effects of change of P, I and D variables on system response referencing; set point/load changes, offset/steady state errors, overshoot, initial rate of change, setting time
- Identify and explain the use of basic, two input logic gates, truth tables, determine the output of combination of gates.

4. System Diagrams

- Identify and explain the purpose of symbols highlighted on a typical Pipe and Instrument Diagram.