

Q1 (16 marks)

With Reference to Ship Stabilisers usually used in passenger ships:

- (a) Explain the Operational principle of a ship's stabiliser. (8)
- (b) Describe with sketches Active and Passive types of stabilizers. (8)

Q2 (16 marks)

With regards to boiler water level control. Explain the following:

- (a) Shrink and swell phenomenon (4)
- (b) Cascade control (4)
- (c) Split control (4)
- (d) Condensing chamber – Function and location. (4)

Q3 (16 marks)

(a) Describe the key phases and microstructures in the iron-carbon equilibrium diagram and explain their significance in the heat treatment of steel. (8)

(b) How do the different regions of the iron-carbon diagram influence the mechanical properties of steel, such as hardness, toughness, and ductility? Provide examples of how specific compositions and heat treatments can achieve desired properties. (8)

Q4 (16 marks)

With reference to shaft alignment:

- (a) Explain the meaning of fair curve or rational alignment. (6)
- (b) Shaft alignment is often verified using hydraulic jacks to obtain a simple graph. Sketch such a graph, indicating the following: (6)
 - (i) Static load;
 - (ii) Hysterests;
 - (iii) Influence number;
- (c) Explain the limitations of checking shaft alignment solely by hydraulic jacking methods. (4)

Q5 (16 marks)

With respect to Energy efficient running of ships.

- (a) Sketch and explain the optimization of propeller hull interface flow devices and improvement of propulsion efficiency. (8)
- (b) Sketch and explain the optimization of Auxiliary machinery using VFDs. (8)

Q6 (16 marks)

(a) Examine in detail three common but entirely different reasons for loss of steering gear systems. (5) (b) State how failure is inhibited by the design, operation and maintenance of steering gear systems (5) (c) Describe how a vessel may make port upon irreparable failure of the steering telemotor. (6)

Q7 (16 marks)

(a) Draw a block diagram for a fully automated accommodation air conditioning unit, labelling the component parts and indicating the directions of air flow. (8)

(b) Explain why the unit includes means of dehumidification and humidification. (4)

(c) A chart is used for ensuring that the accommodation conditions are within the so-called Comfort Zone: what useful information does the chart give? (4)

Q8 (16 marks)

With reference to plate heat exchangers, explain how EACH of the following design aspects promote heat transfer:

(a) Material selection; (6)

(b) Flow pattern; (6)

(c) Extended surface area. (4)

Q9 (16 marks)

Explain how the ingress of sea water is prevented in an oil lubricated stern bearing system. Should the system fail, describe the corrective action possible whilst the vessel is afloat. State why two stern bearing oil header tanks are fitted in some instances? (16)