



UK MARINE TRAINING CENTRE (UMTC)

SAI POOJA BUILDING, SHOP NO. 4, PLOT NO. 36, SECTOR - 34. KAMOTHE, NAVI
MUMBAI - 410 209 MAHARASHTRA, INDIA.

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December 2020

Attempt TEN questions only as follows

SIX questions from each section A

TWO questions from section B

TWO questions from section C

Marks for each part question are shown in brackets.

SECTION A

Q1. With reference to steels used in shipbuilding and marine engineering:

(a) describe EACH of the following types of failure;

(i) brittle failure; (2)

(ii) ductile failure. (2)

(b) Explain the term ductile to brittle transition stating the factor that determines ductile to brittle transition. (2)

(c) Describe a test to determine the value of brittle fracture of a specimen test piece. (4)

2018/OCT/Q1	2020/DEC/Q1					
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Q2. (a) Describe, with the aid of a sketch, a temperature measuring instrument that uses the principle of operation of a change in resistance with the application of heat. (6)

(b) Describe how the instrument sketched in part (a) is tested and calibrated. (4)

2018/DEC/Q2	2020/DEC/Q2					
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Q3. Discuss the advantages and disadvantages of electrical remote monitoring and control systems compared to pneumatic systems. (10)

2016/OCT	2017/JUL/2	2020/DEC/3				
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Q4. With reference to main thrust block arrangements

- (a) Explain how the tilting pads assist in the formation of an oil wedge (2)
- (b) Describe the actions that may be taken if upon inspection the pads are found to be
 - (i) Lightly scored (2)
 - (ii) Wiped (2)

(c) Explain how the thrust clearance may be measured, stating a typical value (2)

(d) State the possible effects if the thrust clearance is incorrect (2)

2020/DEC/4					
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Q5. With reference to centrifugal pumps;

- (a) Sketch double entry impeller showing directions of flow (3)
- (b) Explain why double entry impellers are fitted (2)
- (c) Explain, with the aid of a head versus flow diagram, why a two speed pump is preferable to throttling where high and low capacities are demanded for a large sea water circulating pump. (5)

2020/DEC/5					
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Q6. (a) Sketch an oily water separator that compiles with current MARPOL regulations

- (b) Describe a monitoring system that ensures that the oil discharge content is below the recommended maximum and that logs and retains data. Also mention any other measures to ensure that illegal discharges are prohibited.

2020/DEC/6					
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Q7. (a) State the possible causes for EACH of the following auxiliary diesel engine lubricating oil sample results

- (i) High acidity (2)
- (ii) High sediment content (2)
- (iii) Excessive water content (2)



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(iv) Fuel dilution (2)

(b) explain which of the results in Q(a) would give greatest concern (2)

2020/DEC/7					
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Q8. (a) The international management code for the safe operation of ships and for pollution prevention, is commonly referred to as the ISM code.

(A) Explain the objectives of ism and how are they achieved. (5)

(b) List five emergency scenarios for which contingency plans may be developed under ism with respect to the engine room (5)

2017/DEC/7	2020/DEC/8					
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SECTION - B

Q9. Describe, with the aid of a block diagram, the operation of a load sensing electronic governor controller for an a.c. generator. (10)

2014/APR	2015/JULY	2017/JUL/10	2020/DEC/9			
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Q10. With reference to braking of a.c induction motors

(a) Explain why braking may be required (2)

(b) Explain why electrical braking is preferable to mechanical braking (2)

(c) Explain the term plugging (2)

(d) Describe how dynamic braking is achieved (4)

2020/DEC/10					
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Q11. With reference to electrical system protective devices, explain the purpose of EACH of the following:

(a) overcurrent protection (2)

(b) Short circuit protection (2)

(c) No-volt protection (2)

(d) Reverse power protection (2)



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(e) Preferential tripping (2)

2020/JUL	2020/DEC/11					
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SECTION – C

Q12. (a) State the system of classification for access doors passing through watertight bulkheads of a vessel. (3)

(b) State THREE circumstances under which all watertight doors must be closed when situations are defined as potentially hazardous. (3)

(c) Explain the safety features built into the watertight door operating system to enhance safety to personnel. (4)

2014/DEC	2015/MAR	2017/JUL/14	2020/DEC/12			
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Q13. Describe the items that should be inspected to ensure that the conditions of assignment of load line are satisfactorily complied with. (10)

2020/DEC/13					
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Q14. Describe how EACH of the following defects on a solid propeller may be repaired whilst a ship is in drydock

(a) Bent blades (2)

(b) Damaged blade tips (4)

(c) Pieces of blade missing (4)



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2020/DEC/13					
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October 2020

Attempt TEN questions only as follows

SIX questions from each section A

TWO questions from section B

TWO questions from section C

Marks for each part question are shown in brackets.

SECTION A

Q1. (a) Sketch a Stress/Strain curve for a mild steel test specimen. (2)

(b) With reference to the curve sketched in part (a), explain EACH of the following:

- (i) modulus of elasticity; (2)
- (ii) percentage elongation; (2)
- (iii) ultimate tensile stress; (2)
- (iv) yield stress. (2)



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2019/MAR/Q1	2020/OCT/Q1					
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Q2. Explain EACH of the following metallurgical process

(a) Induction hardening (3)

(b) Nitriding (3)

(c) Case hardening (4)

2020/OCT/Q2						
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Q3. (A) Explain EACH of the following control terms

(i) Proportional action (2)

(ii) Integral action (2)

(B) Describe, with the aid of a sketch, a control system that may be enhanced by the inclusion of a cascade control. (6)

2020/OCT/Q3						
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Q4. With reference to vessels fitted with podded propulsion systems capable of being rotated through 360°:

(a) state the advantages claimed over conventional shafting and steering arrangements; (6)

(b) state, with reasons, the type of vessels that are most suited to this means of propulsion. (4)

2017/OCT/3	2020/OCT/Q4					
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Q5. Describe the principle of operation of a biological sewage treatment plant. (4)

(b) Explain how anaerobic conditions can occur within a sewage treatment plant, stating the hazards that may be encountered. (4)

(B) Explain the meaning and significance of the term biological oxygen demand (2)



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2020/OCT/Q5						
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Q6. With reference to ships air conditioning plant:

- (a) Define the term comfort zone (2)
- (b) State the objectives of maintaining the conditioned air within the comfort zone (3)
- (c) State, with reasons, FIVE areas from which the conditioned air must not be recirculated. (5)

2020/OCT/Q6						
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Q7. During bunkering operations, a section of deck bunker line starts leaking fuel oil from a pinhole at the mid-section of the pipe.

- (a) As Chief Engineer Officer, state the immediate actions to be taken to avoid a potential pollution incident; (4)
- (b) Explain how a permanent repair could be made, stating any precautions to be taken and any further inspections that would be required. (6)

2019/DEC/Q8	2020/OCT/Q6					
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Q8. With reference to fixed machinery space firefighting system which use water in the form of fog or mist, explain EACH of the following.

- (a) How the fire is contained and extinguished (4)
- (b) The importance of particle size and flow rate (4)
- (c) The routine testing to be carried (2)

2020/OCT/Q8						
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SECTION – B

Q9. With reference to the protective devices fitted to a main alternating current generator, explain EACH of the following:

- (a) overcurrent and short circuit protection; (2)
- (b) generator negative phase sequence; (2)
- (c) loss of field (excitation); (2)
- (d) undervoltage; (2)
- (e) reverse power. (2)

2019/DEC/Q9	2020/OCT/Q9					
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Q10. With reference to *star delta* starters used for three phase induction motors;

- (a) explain in detail why this type of starter is employed. (4)
- (b) explain, with the aid of a circuit diagram, the sequence of operation of a star delta starter. (6)

2020/JUL	2020/OCT/10					
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Q11. (a) Explain, with the aid of a sketch, the principle of operation of an earth leakage detection system of the instrument type (6)

- (b) Explain why an insulated neutral system is used extensively on-board ships (2)
- (c) State, with reasons, why a single earth fault on an insulated neutral system should always be cleared as soon as possible (2)

2020/OCT/11						
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SECTION -C

Q12. With reference to ship construction:

- (a) Explain why conventional liquid carriers are divided by longitudinal bulkheads. (2)
- (b) Explain why ore carriers may be fitted with wing tanks (2)
- (c) State, other than the carriage of liquids, the purposes of double bottom tanks in dry cargo ships.
- (d) State FOUR reasons for transverse watertight bulkheads in ship construction (4)

2020/OCT/12						
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Q13. With reference to structural fire protection in passenger ship accommodation spaces;

- (a) Define the meaning of EACH of the following
 - (i) Class A Bulkheads (3)
 - (ii) Class B Bulkheads (3)
- (b) Where class A bulkheads have to be penetrated, explain how the integrity of the bulkhead is retained with respect to EACH of the following.
 - (i) Doors (2)
 - (ii) Ventilation trunking (2)

2020/OCT/13						
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Q14. As chief engineer officer outline the essential information to be supplied to the drydock management prior to drydocking a vessel. (10)

2020/OCT/14						
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July 2020

Attempt TEN questions only as follows

SIX questions from each section A

TWO questions from section B

TWO questions from section C

Marks for each part question are shown in brackets.

SECTION A

Q1. Discuss the factors that lead to the selection of materials for use in a sea water cooled, multi-tubular heat exchanger. (10)

2016/JULY	2020/JULY					
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Q2. Describe, with the aid of a sketch, the principle of operation of a capacitance electrode level measuring transmitter. (10)

2013/MAR	2015/DEC	2017/MAR/5	2020/JUL			
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Q3. With reference to propeller cavitation;

(a) define cavitation (2)

(b) describe FOUR detrimental effects of propeller cavitation (8)

2020/JUL						
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Q4. With reference to pump selection, state any TWO types of pump for EACH of the following applications, stating why they are suitable.

(a) bilge pumping (2)

(b) Cargo oil stripping (2)

(c) Sewage sludge (2)

(d) Lubricating oil circulating (2)



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(e) Sea water circulating (2)

2013/OCT	2016/DEC	2020/JUL				
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Q5. (a) Sketch the hydraulic circuit for a ram type steering gear that complies with the single failure concept and automatic isolation. (6)

(b) Describe how automatic isolation, for the hydraulic circuit sketched in part (a), is achieved within 45 seconds should leakage of system oil occur. (4)

2014/JULY	2015/DEC	2018/JUL/Q5	2020/JUL			
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Q6. With reference to the treatment of domestic water for potable use.

(a) describe the principle of operation of a steriliser that uses silver ions; (4)

(b) State the advantages of silver ion sterilisation over other methods; (2)

State the inspections and maintenance that should be carried out on EACH of the following;

(i) Fresh water tanks (2)

(ii) calorifiers (2)

2020/JUL						
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Q7. (a) State a block diagram of a fully automated air conditioning system for accommodation spaces, annotating the relevant temperatures and relative humidities throughout the system.(7)

(b) Describe how bacteria are prevented from multiplying to a harmful level in an air conditioning system. (3)

2015/JULY	2015/DEC	2020/JUL				
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Q8. As chief engineer officer appointed to a newly acquired vessel, describe the inspection that should be carried out to ensure satisfactory condition and operation of the ship's fire fighting equipment. (10)

2015/DEC	2020/JUL					
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SECTION – B

Q9. Describe, with the aid of a block diagram, how automatic starting load sharing and stopping of generators in response to load changes is effected. (10)

2014/DEC	2016/JULY	2020/JUL				
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Q10. With reference to *star delta* starters used for three phase induction motors;

(a) explain in detail why this type of starter is employed. (4)

(b) explain, with the aid of a circuit diagram, the sequence of operation of a star delta starter. (6)

2014/OCT	2016/OCT	2020/JUL				
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Q11. With reference to electrical system protective devices, explain the purpose of EACH of the following;

(a) overcurrent protection (2)

(b) Short circuit protection (2)

(c) No-volt protection (2)

(d) Reverse power protection (2)

(e) Preferential tripping (2)

2020/JUL						
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SECTION –C

Q12. (a) Describe, with the aid of sketch, how a hydraulically operated folding hatch cover opens and closes. (7)

b) Explain how the water tightness and security of the hatch cover sketched in part (a) can be ascertained before proceeding to sea. (3)

2013/DEC	2016/JULY	2020/JUL				
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Q13. (a) state the advantages and disadvantages of aluminium alloy in ship building. (4)

(b) Describe, with the aid of sketch, a method of welding aluminium panels. (6)

2015/JULY	2020/JUL					
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Q14. With reference to the international conventional for the control and management of ship's Ballast Water and Sediments

- (a) state the aims of the Ballast Water Management Convention; (2)
- (b) Explain the difference between ballast water standards D-1 and D-2; (2)
- (c) State with reasons, the documentation required by ships in international traffic to manage their Ballast Water and Sediments; (6)

2020/JUL						
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