



# 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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## March 2017

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) State the factors in the storage of welding electrodes which will assist in producing good quality welds. (2)

(b) Explain the importance of edge preparation before welding. (2)

(c) Sketch TWO methods of plate edge preparation. (2)

(d) A hairline crack is detected in a pipe, as Chief Engineer Officer, state the factors to be taken into account in reaching a decision on the method of repair. (4)<sup>[1-1]</sup><sub>[SEP]</sub>

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Q2. (a) Sketch an outboard radial lip seal as fitted to an oil lubricated stem tube. (5)

(b) Explain the procedure for replacing the seal sketched in part (a) without removing the tail shaft. (5)

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Q3. With reference to static oily water separators, explain EACH of the following:

(a) why the supply pump should be carefully selected and matched to the separator; (2)

(b) how the separator achieves effective separation; (4)



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(c) how the physical properties of each of the fluids to be separated affects the rate and effectiveness of separation. (4)

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Q4. With reference to ships' air conditioning systems:(a) state the effects of EACH of the following faults:

(i) corroded return air trunkings; (2)

(ii) blocked evaporator drains; (2)

(iii) defective capacity control. (2)

(b) state the main health hazard that may arise in the air conditioning plant, stating the conditions that need to arise and the measures that should be taken to prevent this occurring. (4)

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Q5. Describe, with the aid of a sketch, the principle of operation of a capacitance electrode level measuring transmitter. (10)

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Q6. With reference to fuel with high pour point:

(a) describe test that may be carried out;(4)

(b) state the measure to be taken to enable the ship to use the fuel.(6)

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Q7. With reference to automatic sprinkler systems for fire fighting purposes:

(a) explain, with the aid of a Heat Release versus Time diagram, the difference between

*fire control* and *fire suppression*; (6)



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(b) state the limitations of using glass bulbs to activate sprinkler heads and suggest, with reasons, an alternative mechanism. (4)

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Q8. (a) State THREE modes of heat transfer. (1)

(b) Describe how the design requirements of EACH of the following are met, detailing the materials used to promote or retard heat transfer:

(i) plate cooler in central cooling system; (3)

(ii) meat room in domestic provisions space; (3)

(iii) auxiliary steam system pipelines. (3)

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## SECTION - B

Q9. (a) Sketch a circuit diagram of a self-excited a.c. generator. (5)

(b) Describe the operation of the circuit sketched in part (a). (5)

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Q10. 10. During a complete loss of electrical power, essential vital services can be maintained by means of an Uninterruptable Power Supply (UPS).

(a) Describe, with the aid of a block diagram, the operation of an a.c. input UPS arrangement. (7)

(b) List SIX essential services that the UPS may support. (3)

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Q11. With reference to the protection of electrical equipment in a distribution system:

(a) state the aims of the protective devices; (3)



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(b) list the parameters that are monitored and acted upon by the protective devices; (4)

(c) state, with reasons, THREE causes of electrical fires. (3)

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## SECTION - C

Q.12. Q12. Describe the in-water survey to classification society requirements of the underwater structure of a very large carrier. (10)

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Q.13. 13. Describe, with the aid of sketches, how main propulsion efficiency can be improved by the addition of EACH of the following:

(a) ducted propeller (Kort nozzle) ;(5)

(b) vane or Grim wheel aft of the propeller. (5)

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Q.14. (a) With reference to bilge keels:

(i) describe how the design and method of attachment reduces the possibility of damage to the shell plate; (5)

(ii) state what testing must be carried out. (2)

(b) Explain why the bilge keels do not extend the full length of the vessel. (3)

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## July 2017

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) Discuss the merits of a condition monitoring system compared to other maintenance regimes. (5)

(b) Describe how the data is gathered, stored and evaluated on a computer-based vibration analysis system. (5)

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Q2. Discuss the advantages and disadvantages of electrical remote monitoring and control systems compared to pneumatic systems. (10)

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Q3. (a) Sketch an engine room fresh water central cooling system, indicating the water temperatures at salient points on the system. (6)

(b) State, with reasons, FOUR advantages of the system sketched in part (a) compared to one which is totally sea water cooled. (4)

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Q4. With reference to centrifugal pumps and pumping systems:

(a) explain, with the aid of a diagram, the distinction between Net Positive Suction Head available (NPSHa) and Net Positive Suction Head required (NPSHr); (8)

(b) explain how the NPSHa may be increased by design. (2)

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Q5. Describe, with the aid of a block diagram, a compensated control system for an active fin stabilization unit. (10)

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Q6. With reference to a domestic refrigeration plant, state TWO causes of EACH of the following conditions, stating how EACH cause may be rectified:

(a) excessive pressure; (2)

(b) low pressure at evaporator suction; (2)

(c) compressor cycling; (2)

(d) compressor running for long periods but not lowering the temperature in the cold rooms (2)

(e) compressor operating noisily. (2)

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Q7. With reference to medium speed auxiliary diesel engines:

(a) explain why twin air inlet and exhaust valves are often fitted to each cylinder head; (6)

(b) explain why, in some cases, valve rotation is employed. (4)

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Q8. The company, with which you are employed, requests that all Chief Engineer Officers prepare standing orders regarding the prevention and detection of fires in the machinery spaces.

Compile such a list of recommendations to be submitted to central office. (10)

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## SECTION – B

Q9. With reference to automatic Power Management Systems for the control of the operation of main switchboards and generators:

(a) list the features that the Power Management System controls in order to comply with the requirements for a vessel; (7)

(b) explain how the generators and switchboard would be controlled following a failure of the Power Management System. (3)

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Q10. Describe, with the aid of a block diagram, the operation of a load sensing electronic governor controller for an a.c. generator. (10)

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Q11. With reference to a THREE phase electrical distribution system:

(a) discuss the advantages and disadvantages of an insulated neutral system; (8)

(b) state how an earthed neutral system is earthed and the measures taken to limit the maximum earth fault current. (2)

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## SECTION – C

Q12. (a) State, with reasons, the potential hazards that may be present in EACH of the following spaces:

(i) an oily bilge tank; (2)

(ii) a ballast tank; (2)

(iii) a refrigerated space. (2)

(b) State the procedures to be undertaken prior to entering enclosed spaces. (4)

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- Q13. (a) Explain why twin skeg rudders may be fitted on some vessels. (3)  
(b) Explain the advantages of a twin skeg installation in modern vessels with a large cargo carrying capacity. (7)

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- Q14. (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)

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## October 2017

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

- (a) material selection;(5)
- (b) flow pattern; (3)
- (c) extended surface area. (2)

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Q 2. With reference to pneumatically operated control valves:

- (a) state the reason for fitting valve positioners; (4)
- (b) with the aid of a sketch, explain valve hysteresis and how it affects the process; (4)
- (c) describe how the design and routine maintenance can limit hysteresis. (2)

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Q 3. 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)

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Q4. Describe, with the aid of a sketch, a Membrane Bioreactor type sewage treatment plant. (10)

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Q5. (a) Describe TWO systems of priming centrifugal pumps. (6)

(b) List the advantages of EACH of the priming methods described in part (a). (4)

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Q6. With reference to bacteria harmful to humans in drinking and washing water:

(a) state the constraints placed on the installation and use of systems for shipboard production of fresh water; (3)

(b) state the maintenance and treatment recommended for fresh water tanks; (3)

(c) describe how the entire fresh water system can be made free from bacteria; (3)

(d) state an acceptable residual value in the fresh water tanks to ensure the correct concentration of treatment in the system. (1)

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Q7. With reference to deck machinery:

(a) sketch a line diagram showing the layout and components of a hydraulic system with a variable delivery, pressure compensated pump and accumulator, suitable for the operation of deck machinery; (5)

(b) explain the advantages of using electrically driven machinery over hydraulically driven winches and windlasses. (5)

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Q8. Explain the legal, administrative and technical responsibilities of a Chief Engineer Officer. (10)

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## SECTION – B

Q9. State the main electrical items covered in a Classification Society periodical survey. (10)

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Q10. (a) State FIVE essential electrical services that are able to be operable under fire conditions. (5)

(b) Explain how electric cables for the essential services in part (a) pass through bulkheads whilst maintaining gas tight and watertight integrity. (3)

(c) State the requirements for the cables which supply electrically driven emergency fire pumps. (2)

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Q11. With reference to large electrical transformers on board ships:

(a) state where these transformers may be used; (1)

(b) state a typical efficiency range for a transformer; (1)

(c) state the regulations pertaining to transformers; (3)

(d) state the protective devices that are fitted; (2)

(e) describe the maintenance requirements. (3)

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## SECTION –C

Q12. With reference to cargo hatch covers on large container ships:

- (a) describe how they are tested for weathertightness; (2)
- (b) explain how the weight of the hatch and containers is transferred to the ship's structure whilst allowing for deflections of the hull in a seaway; (3)
- (c) describe, with the aid of a sketch, the type and location of damage that can occur due to wear of the hatch supporting arrangements. (5)

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Q13. (a) With reference to bilge keels:

- (i) describe how the design and method of attachment reduces the possibility of damage to the shell plate; (5)
  - (ii) state what testing must be carried out. (2)
- (b) Explain why the bilge keels do not extend the full length of the vessel. (3)

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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)

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## December 2017

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.

Q1. Describe, with the aid of a graph, EACH of the following types of ferrous material failure, stating

ONE practical example of EACH:

1. creep; (5)
2. fatigue. (5)

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Q2. (a) Define propeller slip, explaining how it is calculated. (2)

(b) State, with reasons, FOUR conditions which will affect the propeller slip. (8)

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Q3. Describe, with the aid of a sketch, the operation of a static Oily Water Separator which conforms to current MARPOL regulations and utilises a pump on the discharge side of the separator. (10)

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Q7. (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)

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Q8. With reference to fixed installations for machinery space fires:

(a) sketch a CO2 bottled system; (5)

(b) explain how the system sketched in part (a) is protected from overpressure; (2)

(c) describe the periodic maintenance required. (3)

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## SECTION – B

Q9. With reference to overcurrent protection for electrical circuits:

(a) explain THREE methods of protection, stating where EACH may be used; (6)

(b) explain, with the aid of a diagram, the meaning of the term inverse current time characteristic. (4)

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Q10. With reference to three-phase induction motor starters:

- (a) explain why star-delta starters are employed; (2)
- (b) explain what is meant by reduced voltage starting in the context of star-delta starters. (2)
- (c) explain, with the aid of a power circuit, the sequence of operation of a start-delta starter. ( 6)

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Q11. Explain the meaning of EACH of the following types of electrical equipment:

- (i) intrinsically safe; (2)
  - (ii) flameproof; (2)
  - (iii) increased safety; (2)
  - (iv) pressurised enclosure. (2)
- (b) State TWO types of lighting equipment that may be installed in the pump room areas of a crude petroleum carrier. (2)

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## **SECTION -C**

Q12. Q12. With reference to structural fire protection in passenger ship accommodation spaces:





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(a) define the meaning of Class A bulkheads, stating the requirements; (3)

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(b) discuss the design of ventilation systems to prevent the spread of smoke and fire; (5)

(c) explain how the integrity of the bulkhead is retained with respect to ventilation trunkings, where A Class bulkhead have to be penetrated. (2)

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Q13. As Chief Engineer Officer of an older vessel which has recently been purchased, write a report to the Superintendent Engineer detailing the items that should be inspected to ensure that the conditions of assignment are satisfactorily complied with. (10)

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Q14. (a) Describe the survey of a hollow rudder. (7)

(b) Explain the possible effects if the watertight integrity of the rudder was compromised. (3)

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