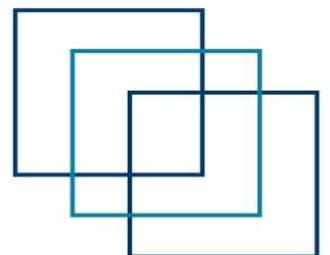


# ELECTRO TECHNICAL OFFICER : WRITTEN

FOR INDIAN COMPETENCY EXAM

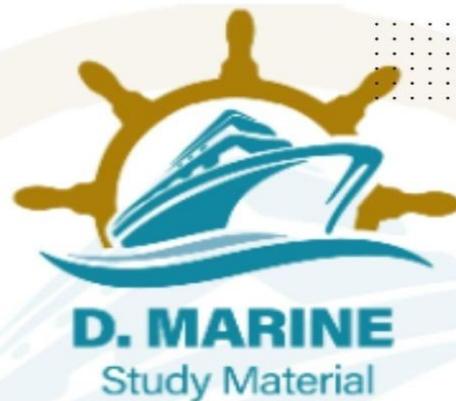


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## JAN - 2022

Q1. (a) Draw circuit diagram and explain working of Star - Delta starter. (8)  
(b) Explain with diagram how direction of single phase induction motor is reversed. (8)

2021/OCT/Q1 2022/JAN/Q1

[Click Here to See the Answer](#)

Q2. Briefly explain the principle of operation of Variable Frequency Drives (VFD). Discuss the advantages and disadvantages of VFDs onboard merchant vessels? (16)

2021/FEB/Q2 2021/APR1/Q1 2022/JAN/Q2

[Click Here to See the Answer](#)

Q3.a) Explain three methods of overcurrent protection for electrical circuit.  
b) Explain with aid of diagram, the meaning of the term inverse current time characteristic (8)

2020/MAR/Q2 2020/OCT/Q2 2020/DEC/Q2 2021/FEB/Q3  
2021/APR2/Q3 2021/JUL/Q2 2021/APR1/Q2 2021/JUL2/Q2  
2021/OCT/Q3 2021/DEC/Q2 2022/JAN/Q3

[Click Here to See the Answer](#)

Q4. (a) Explain the principle of a Transformer? Discuss the various types of transformers used onboard? (8)  
(b) In a container ship, a 3 -ph, delta/delta connected 6600/440 V, 60 Hz transformer is feeding AMP supply from shore to 440 Volt switchboard. Transformer primary current takes a line current of 100 amp, when secondary load of 0.8 Lagging p.f. is connected. Determine each coil-current and KW output of transformer. (8)

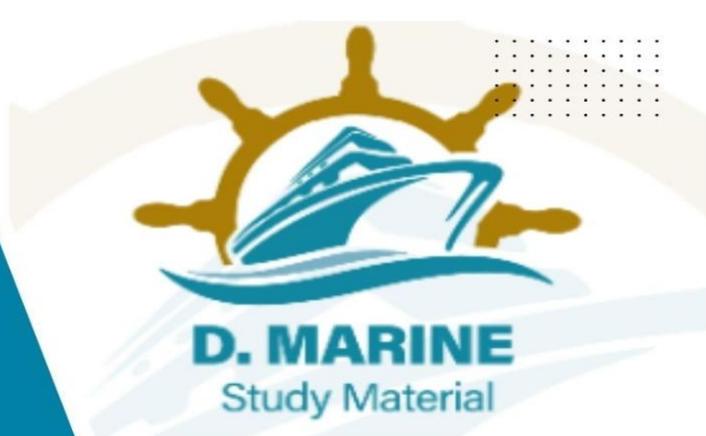
2020/FEB/Q6 2021/OCT/Q4 2022/JAN/Q4

[Click Here to See the Answer](#)

Q5. A circuit has a resistance of  $3 \Omega$  and an inductance of  $0.01H$ . The voltage across its ends is  $60V$  and the frequency is  $50Hz$ . Calculate



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- a) The impedance (6)
- b) The power factor (5)
- c) The power absorbed. (5)

**2022/JAN /Q5**

[Click Here to See the Answer](#)

Q6. With respect to Alternators onboard:

- a) Briefly explain true power, Apparent power and power factor? (8)
- b) The alternator is rated for 750 KVA at 0.85 PF, what is the maximum load (Kilo Watt) that can be put on it? Would you be overloading the alternator if the kilowatt reading were now 620 KW and the power factor 0.80? (8)

**2019/DEC/Q6** **2021/FEB/Q6** **2021/APR1/Q4** **2021/JUL/Q5**

**2022/JAN/Q6**

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Q7. (a) With reference to working onboard the Deck Cargo crane, elaborate the hazards associated with working at heights? (5)

(b) What risk mitigation measures will you take to mitigate the hazards identified by you while working at heights? (6)

(c) Which all risk assessment checklists, work checklists and work Permits will you fill up before commencing the work and who will authorize the work permits? (5)

**2022/JAN /Q7**

[Click Here to See the Answer](#)

Q8. With Reference to Electrical Safety onboard a vessel:

a) Write Short note on “Electric Shock” (6)

b) Enumerate the relation between Shock Current Levels, the Applied Voltage and the Body resistance.

c) How do you treat a person who has suffered an electric shock onboard from a AC supply? (5)

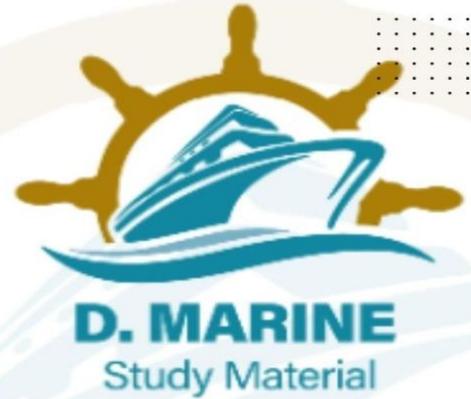
**2019/DEC/Q8** **2020/DEC/Q8** **2021/JUL /Q9** **2021/NOV/Q8**

**2022/JAN /Q8**

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- Q9. With reference to entry into enclosed spaces onboard:
- Define “Enclosed space” and give example of enclosed spaces onboard
  - Describe the checks done for testing the atmosphere inside such enclosed spaces. (5)
  - Explain safety precautions taken prior to entry into enclosed spaces onboard vessel. (5)

**2020/MAR/Q7** **2021/JAN/Q8** **2021/MAR/Q7** **2021/APR2/Q8**

[Click Here to See the Answer](#)

#### FEB - 2022

- Q1. With Respect to PLC's used onboard ships:
- Draw and explain the block diagram of a PLC? (8)
  - Name the onboard ship equipment where PLC's are used (4)
  - What are the advantages of PLC controllers over other type of controllers. (4)

**2020/FEB/Q4** **2021/JAN/Q4** **2021/FEB/Q4** **2021/APR2/Q4**

**2022/FEB/Q1**

[Click Here to See the Answer](#)

- Q2. a) Briefly Explain Intrinsically safe circuit and Explosion proof circuit.  
b) What is EXD and EX1? Where they are used onboard ship. (3)  
c) What all Intrinsically safe equipment used on Deck, Explain how they are Intrinsically safe. (3)  
d) What is Zener Barrier? How flame and explosion contained inside the enclosure. (4)

**2022/FEB/Q2**

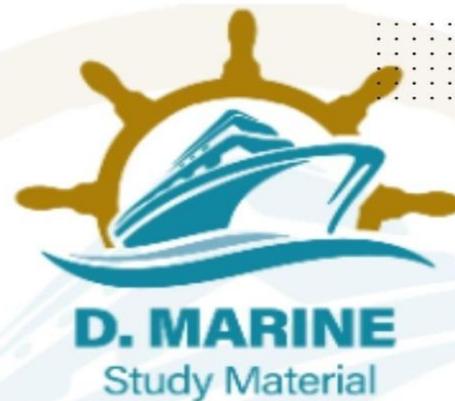
[Click Here to See the Answer](#)

- Q3. a) Explain why it is necessary to have reverse power protection for alternators intended for operation. (6)  
b) (i) Sketch a reverse power trip. (5)  
(ii) Briefly explain the principle on which the operation of this power trip is based and how tripping is activated. (5)

**2021/JAN/Q2** **2022/FEB/Q3**



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Q4. With respect to circuit breakers:

a) Compare the effectiveness of a current limiting circuit breaker with that of a HRC fuse. (6)

b) A coil having a resistance of 10 ohm and an inductance of 0.15 H is connected in series with a capacitor across a 100 V, 50 Hz supply. If the current and the voltage are in phase what will be the value of the current in the circuit and the voltage drop across the coil? (10)

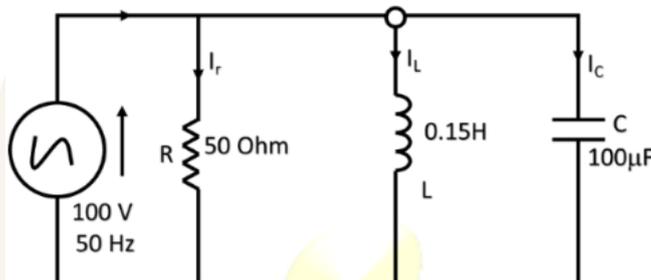
2019/JUL/Q5 2021/JAN/Q5 2021/DEC/Q5 2022/FEB/Q4

[Click Here to See the Answer](#)

Q5. With reference to adjoining circuit calculate following

a) Current in each branch of circuit (8)

b) Total current (8)



[Click Here to See the Answer](#)

Q6. A 100 KVA, 2400/240 V, 50 Hz, 1-phase transformer has no-load current of 0.64 A and a core loss of 700 W, when its high voltage side is energized at rated voltage and frequency. Calculate the two components of no-load current. If this transformer supplies a load current of 40 amp at 0.8 lagging power factor at its low voltage side, determine the primary current and its power factor. Ignore leakage impedance drop. (16)

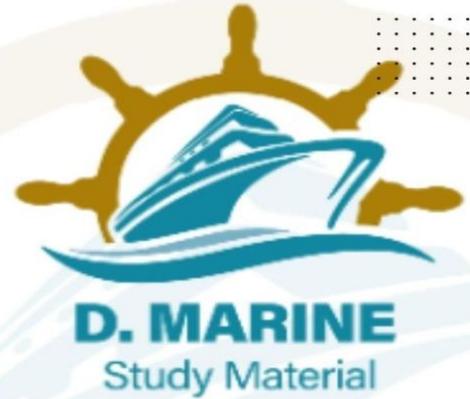
2021/JAN/Q6 2021/APR1/Q6 2021/JUL2/Q6 2021/OCT/Q6

2021/DEC/Q6 2022/FEB/Q6

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Q7. a) Describe the routine tests required for self-contained breathing apparatus sets (8)

b) Describe the procedure to be adopted to find missing personnel in a smoke-filled accommodation area. (8)

**2020/FEB/Q9** **2020/DEC/Q9** **2021/APR2/Q7** **2021/SEP/Q9**

**2022/FEB/Q7**

[Click Here to See the Answer](#)

Q8. a) Describe CO2 Fixed fire fighting system for machinery spaces and cargo spaces of a bulk carrier.

b) Explain safety precautions taken prior to release of CO2 to the engine room. (8)

**2021/JAN/Q9** **2021/APR1/Q8** **2021/JUL/Q8** **2022/FEB/Q8**

[Click Here to See the Answer](#)

Q9. With reference to entry into enclosed spaces onboard:

a) Define “Enclosed space” and give example of enclosed spaces onboard

b) Describe the checks done for testing the atmosphere inside such enclosed spaces. (5)

c) Explain safety precautions taken prior to entry into enclosed spaces onboard vessel. (5)

**2020/MAR/Q7** **2021/JAN/Q8** **2021/MAR/Q7** **2021/APR2/Q8**

**2021/OCT/Q7** **2021/NOV/Q7** **2021/DEC/Q9** **2022/JAN/Q9**

**2022/FEB/Q9**

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## MAR – 2022

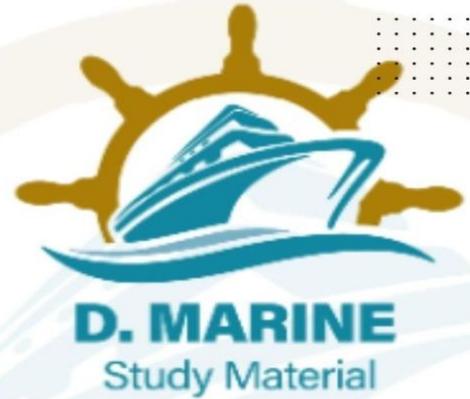
Q1. a) What precautions must be taken when testing the insulation of generator cables and wiring connected to an AVR unit? (6)

b) How could you monitor the correct instant for synchronising, if synchroscope and synchronising lamps are not working? (6)

c) How the air gap of an alternator is measured and why the air gap of an alternator to be checked periodically? (4)



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**2022/MAR/Q1**

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Q2. With Respect to Insulated and Earthed Neutral Systems used on board:  
a) Discuss the Advantages and Disadvantages of both Insulated and Earthed Systems used on board.

b) Discuss the consequences of earth fault in an earthed distribution system. (4)

c) What would be the Ohmic value of the NER to limit the earth fault to the full load rating of a 2 MW, 0.8 pf, 3.3KV, 3Phase A.C. generator? (4)

**2020/OCT/Q4** **2020/DEC/Q1** **2021/MAR/Q3** **2021/APR2/Q1**

**2021/JUL/Q1** **2021/NOV/Q4** **2022/MAR/Q2**

[Click Here to See the Answer](#)

Q3. a) Explain with the aid of a diagram, a controller utilizing proportional plus integral action. (6)

b) List out the Advantages and Disadvantages of electric propulsion system

c) Explain briefly what you know about "Pulse Width Modulation" and how it can be applied for propulsion control. (5)

**2021/APR2/Q2** **2021/APR1/Q1** **2021/SEP/Q3** **2022/MAR/Q3**

[Click Here to See the Answer](#)

Q4.a) Explain the construction and principle of operation of permanent magnet moving coil instrument.

b) A permanent magnet moving coil instrument has a coil of dimension 15 mm × 12mm. The flux density in the air gap is  $1.8 \times 10^{-3}$  wb/m<sup>2</sup> and the spring constant is  $0.4 \times 10^{-6}$  Nm / rad. Determine the number of turns required to produce an angular deflection of 900 when a current of 5 mA is flowing through the coil. (8)

**2022/MAR/Q4**

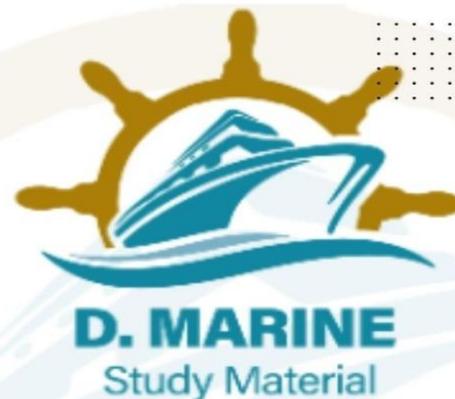
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Q5. A 400V, 4-pole, 50 Hz, 3-phase, 10 hp, star connected induction motor has a no load slip of 1% and full load slip of 4%, find the following:

(i) Syn speed



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- (ii) No -load speed
- (iii) Full load speed
- (iv) Frequency of rotor current at full load
- (v) Full - load torque (16)

**2021/APR2/Q5** **2021/SEP/Q4** **2022/MAR/Q5**

[Click Here to See the Answer](#)

Q6. With reference to Diesel engine driven alternator:

- a) Explain the significance of the term “speed droop” during the parallel operation of alternators. Assuming two alternators are running in parallel, outline the frequency vs load characteristics of the alternators while load sharing. (8)
- b) Two 3Ø alternators operate in parallel, the rating of A is 1000kw and B is 800 kw. The droop setting of each generator is 4%, If the load to be shared by both the generators is 1000 kw, calculate the load sharing by generators A and B, if the original frequency at no-load is 62Hz.

**2021/APR2/Q6** **2022/MAR/Q6**

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- Q7. a) Describe the routine tests required for self-contained breathing apparatus sets (8)
- b) Describe the procedure to be adopted to find missing personnel in a smoke-filled accommodation area. (8)

**2020/FEB/Q9** **2020/DEC/Q9** **2021/APR2/Q7** **2021/SEP/Q9**

**2022/FEB/Q7** **2022/MAR/Q7**

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Q8. With reference to an automatic water sprinkler, fire detecting, alarm and extinguishing system for accommodation spaces:

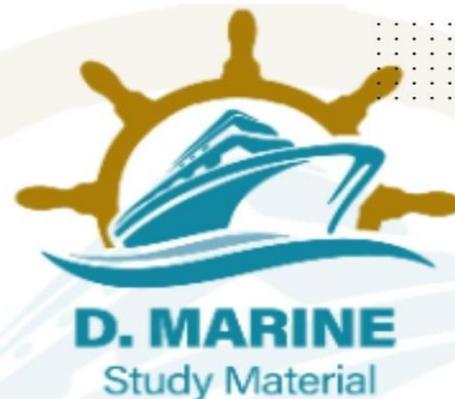
- a) Sketch a typical system and describe the operation of this system. (8)
- b) Describe the sprinkler head and its operation; state how the temperature rating of the sprinkler head is determined. (8)

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Q9. With Respect to MARPOL, Annex V:



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- a) Explain the regulations stipulated for disposal of garbage under annex V of MARPOL 73/78. (8)
- b) State the special areas notified under annex V of Marpol 73/78 (4)
- c) State what precautions you will take during disposal of waste from Electrical workshop (4)

**2021/APR2/Q9** **2022/MAR/Q9**

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### APR - 2022

Q1. Describe with the aid of a simple sketch the arrangement of the three-phase winding of an alternator showing the neutral point. Explain why for most ships the neutral point is insulated. Explain why in some installation the neutral point is earthed. (16)

**2022/APR/Q1**

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Q2. Diesel electric propulsion is now being chosen as the power plant for an increasingly wide variety of vessels. (16)

- a) Sketch a simple layout of such an installation.
- b) Explain the advantages of selecting such a plant.

**2019/DEC/Q2** **2022/APR/Q2**

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Q3. What are semiconductor devices? What are its advantages over thermionic devices? With respect to semiconductor devices describe working principle and application of the following: (16)

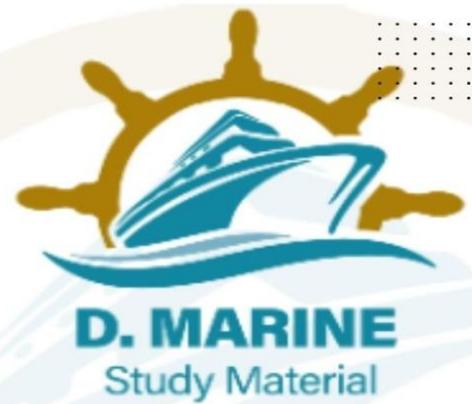
- (a) Zener Diode
- (b) Transistor
- (c) Photocell
- (d) Thyristor

**2022/APR/Q3**

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Q4. A 4-pole, 500V shunt motor has 720 wave connected conductors on its armature. The full load armature current is 60A, and the flux per pole is 0.3wb Armature resistance  $0.2\Omega$ . Calculate the full load speed of the motor to maintain rated terminal voltage at the full load. (16)

**2022/APR/Q4**

[Click Here to See the Answer](#)

Q5. a) Which has the greater equivalent resistance; two equal capacitors in series or in parallel? Explain with reasons? (6)

b) A circuit has a resistance of  $3\Omega$  inductance of 0.01H. The voltage across its end is 60V and the frequency is 50Hz. Calculate

a) the impedance

b) the power factor

c) the power absorbed. (10)

**2020/MAR/Q5** **2020/DEC/Q5** **2021/MAR/Q5** **2021/OCT/Q5**

**2021/NOV/Q5** **2022/APR/Q5**

[Click Here to See the Answer](#)

Q6. With respect to Alternators onboard:

a) Briefly explain true power, Apparent power and power factor? (8)

b) The alternator is rated for 750 KVA at 0.85 PF, what is the maximum load (Kilo Watt) that can be put on it? Would you be overloading the alternator if the kilowatt reading were now 620 KW and the power factor 0.80? (8)

**2021/FEB/Q6** **2021/APR1/Q4** **2021/JUL/Q5** **2022/JAN/Q6**

**2022/APR/Q6**

[Click Here to See the Answer](#)

Q7. With reference to entry into enclosed spaces onboard:

a) Define "Enclosed space" and give example of enclosed spaces onboard

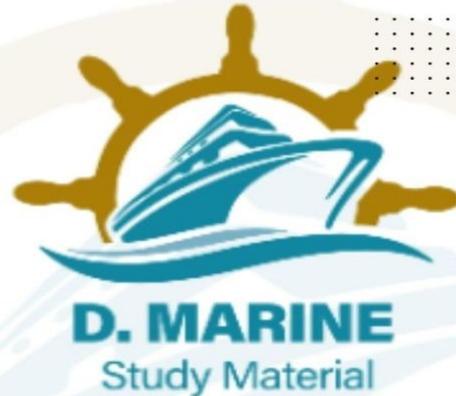
b) Describe the checks done for testing the atmosphere inside such enclosed spaces. (5)

c) Explain safety precautions taken prior to entry into enclosed spaces onboard vessel. (5)

**2020/MAR/Q7** **2021/JAN/Q8** **2021/MAR/Q7** **2021/APR2/Q8**



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2021/OCT/Q7	2021/NOV/Q7	2021/DEC/Q9	2022/JAN/Q9
2022/FEB/Q9	2022/APR/Q7		

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Q8. With respect to the hazardous areas of tankers.

- (a) Explain the term flameproof (Ex d) for electrical equipment. (6)
- (b) State the type of electrical equipment that would be protected in this way. (5)
- (c) List likely defects of flameproof equipment. (5)

2020/MAR/Q9	2020/OCT/Q9	2021/FEB/Q8	2021/APR1/Q7
2021/JUL2/Q7	2021/OCT/Q9	2022/APR/Q8	

[Click Here to See the Answer](#)

Q9. Briefly discuss the following with respect to safety of navigation:

- a) Bridge Navigation Watchkeeping Alarm System (BNWAS) (6)
- b) Long Range Identification and Tracking of ships (LRIT). (5)
- c) Voyage Simplified Voyage Recorder (VDR/S-VDR) (5)

### JUNE - 2022

Q1. With respect to generators and main circuit breakers and their protection devices:

- a) What are safeties incorporated in Air circuit breaker (ACB) of ship's generator and prime mover? (10)
- b) Write Short Note on Negative phase Sequence Relay. (6)

2020/DEC/Q7	2021/NOV/Q1	2022/JUN/Q1
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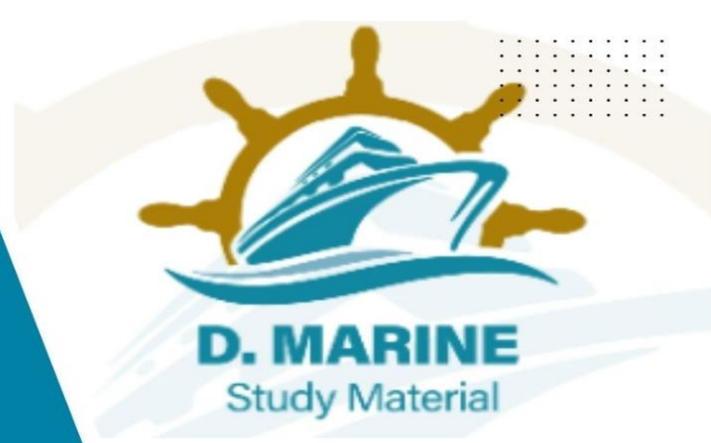
Q2.a) Explain three methods of overcurrent protection for electrical circuit.

b) Explain with aid of diagram, the meaning of the term inverse current time characteristic (8)

2020/MAR/Q2	2020/OCT/Q2	2020/DEC/Q2	2021/FEB/Q3
2021/APR/Q3	2021/JUL/Q2	2021/APR/Q2	2021/JUL/Q2
2021/OCT/Q3	2021/DEC/Q2	2022/JAN/Q3	2022/JUN/Q2



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Q3. What are semiconductor devices? What are its advantages over thermionic devices? With respect to semiconductor devices describe working principle and application of the following: (16)

- (a) Zener Diode
- (b) Transistor
- (c) Photocell
- (d) Thyristor

**2022/APR/Q3** **2022/JUN/Q3**

[Click Here to See the Answer](#)

Q4. a) Which has the greater equivalent resistance; two equal capacitors in series or in parallel? Explain with reasons? (6)

b) A circuit has a resistance of  $3\Omega$  inductance of  $0.01H$ . The voltage across its end is  $60V$  and the frequency is  $50Hz$ . Calculate

- a) the impedance
- b) the power factor
- c) the power absorbed. (10)

**2019/SEP/Q4** **2019/OCT1/Q5** **2020/MAR/Q5** **2020/DEC/Q5**

**2021/MAR/Q5** **2021/OCT/Q5** **2021/NOV/Q5** **2022/APR/Q5**

**2022/JUN/Q4**

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Q5. a) Describe the different type of losses occurring in the power Transformers. (4)

b) A single-phase power transformer supplied a load of  $20\text{ KVA}$  at a P.F of  $0.81$  (lagging). The iron loss of the transformer is  $200\text{kw}$  and the copper loss at this load is  $180\text{kw}$ . Calculate

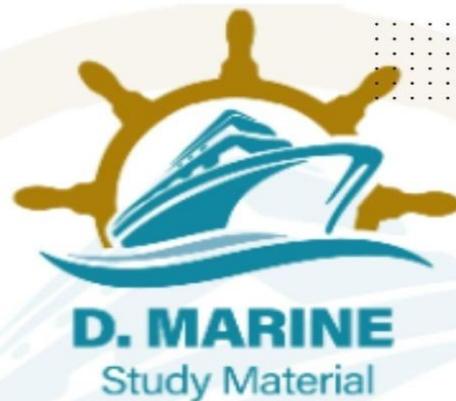
- (i) The efficiency
- (ii) If the load is now changed to  $30\text{ KVA}$  at a p.f of  $0.91$  (lagging). Calculate the new efficiency.

**2020/OCT/Q5** **2021/MAR/Q4** **2022/JUN/Q5**

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Q6. With respect to Alternators onboard:

- Briefly explain true power, Apparent power and power factor? (8)
- The alternator is rated for 750 KVA at 0.85 PF, what is the maximum load (Kilo Watt) that can be put on it? Would you be overloading the alternator if the kilowatt reading were now 620 KW and the power factor 0.80? (8)

2021/FEB/Q6 2021/APR1/Q4 2021/JUL/Q5 2022/JAN/Q6  
2022/APR/Q6 2022/JUN/Q6

[Click Here to See the Answer](#)

Q7. With reference to entry into enclosed spaces onboard:

- Define “Enclosed space” and give example of enclosed spaces onboard
- Describe the checks done for testing the atmosphere inside such enclosed spaces. (5)
- Explain safety precautions taken prior to entry into enclosed spaces onboard vessel. (5)

2020/MAR/Q7 2021/JAN/Q8 2021/MAR/Q7 2021/APR2/Q8  
2021/OCT/Q7 2021/NOV/Q7 2021/DEC/Q9 2022/JAN/Q9  
2022/FEB/Q9 2022/APR/Q7 2022/JUN/Q7

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Q8. With Reference to Electrical Safety onboard a vessel:

- Write Short note on “Electric Shock” (6)
- Enumerate the relation between Shock Current Levels, the Applied Voltage and the Body resistance.
- How do you treat a person who has suffered an electric shock onboard from a AC supply? (5)

2020/DEC/Q8 2021/JUL /Q9 2021/N OV/Q8 2022/JAN /Q8  
2022/JUN /Q8

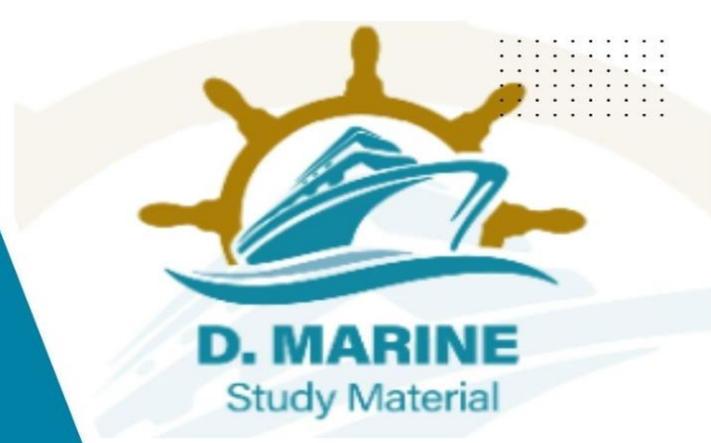
[Click Here to See the Answer](#)

Q9. Briefly discuss the following with respect to safety of navigation:

- Bridge Navigation Watchkeeping Alarm System (BNWAS) (6)
- Long Range Identification and Tracking of ships (LRIT). (5)
- Voyage Simplified Voyage Recorder (VDR/S-VDR) (5)



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**2021/MAR/Q8** **2021/NOV/Q3** **2022/APR/Q9** **2022JUN/Q9**

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### JULY - 2022

Q1. Briefly explain the principle of Operation of induction Motors (4)

a) What is slip for an induction motor? (4)

b) Draw a simple ladder logic diagram of star delta starting of an induction motor. (8)

**2021/APR1/Q2** **2022/JUL /Q1**

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Q2. With reference to batteries onboard:

a) Distinguish between 'Lead acid cell' and 'Alkaline cell' (6)

b) Describe how a battery of alkaline cells may be tested for its usefulness, after a long storage and if found deficient, how it can be remedied? (6)

c) Explain how the ambient temperature is taken into account when determining the condition of the battery (4)

**2020/MAR/Q3** **2020/OCT/Q3** **2022/JUL/Q2**

[Click Here to See the Answer](#)

Q3. What is Zener diode and how does it regulate the voltage? What happens to the series current, load current and Zener current when the d.c input voltage of a Zener regulator increases? Draw a neat diagram of Zener regulator and explain. (16)

**2020/FEB/Q1** **2021/JAN/Q1** **2021/JUL2/Q3** **2022/JUL/Q3**

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Q4. With respect to Insulated and Earthed Neutral Systems used on board:

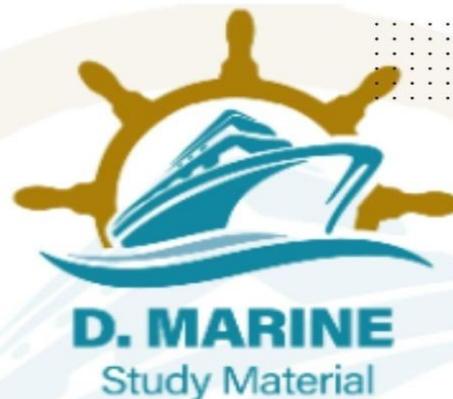
a) Discuss the Advantages and Disadvantages of both Insulated and Earthed Systems used on board.

b) What is earth fault and how do you identify Earth fault in the 440 V system onboard. (4)

c) Discuss the consequences of earth fault in an earthed distribution system. (4)



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**2020/DEC/Q1** **2021/JUL/Q1** **2022/JUL/Q4**

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Q5. With Reference to different types of transformers used onboard.

- Discuss the basic principle of operation of a transformer (5)
- Enumerate the different types of transformers used onboard also state their functions for which they are used. (5)
- A 440/110 V single phase transformer supplies a load of 5KW at 0.8 power factor load. Calculate the primary and secondary currents. (Ignoring transformer power losses)?

**2021/FEB/Q5** **2021/JUL/Q6** **2022/JUL/Q5**

[Click Here to See the Answer](#)

Q6. A 100 KVA, 2400/240 V, 50 Hz, 1-phase transformer has no-load current of 0.64 A and a core loss of 700 W, when its high voltage side is energized at rated voltage and frequency. calculate the two components of no-load current. If this transformer supplies a load current of 40 amp at 0.8 lagging power factor at its low voltage side, determine the primary current and its power factor. Ignore leakage impedance drop. (16)

**2020/MAR/Q6** **2021/JAN/Q6** **2021/APR1/Q6** **2021/JUL2/Q6**

**2021/OCT/Q6** **2021/DEC/Q6** **2022/FEB/Q6** **2022/JUL/Q6**

[Click Here to See the Answer](#)

Q7. How will you fight a fire in a galley? How will you at least restrict the fire if you are the first person to sight the fire in the galley? (16)

**2020/FEB/Q7** **2022/JUL/Q7**

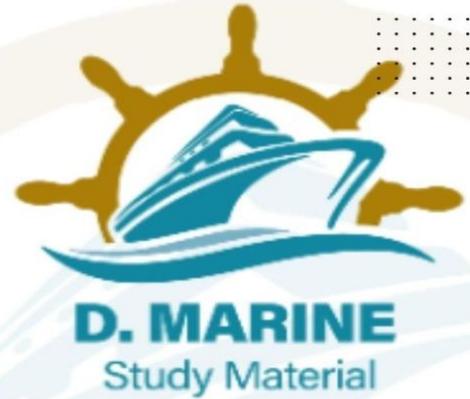
[Click Here to See the Answer](#)

Q8. With reference to MARPOL Annex IV

- Draw a biological sewage treatment plant and explain the principle of operation. (8)
- Periodical maintenance and checks and tests required to be done to verify the effectiveness of the above system. (8)



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[2020/OCT/Q7](#) [2021/JAN/Q7](#) [2021/MAR/Q9](#) [2021/DEC/Q7](#)  
[2022/JUL/Q8](#)

[Click Here to See the Answer](#)

Q9. With respect to the hazardous areas of tankers.

- (a) Explain the term flameproof (Ex d) for electrical equipment. (6)  
(b) State the type of electrical equipment that would be protected in this way. (5)

(c) List likely defects of flameproof equipment. (5)

[2020/MAR/Q9](#) [2020/OCT/Q9](#) [2021/FEB/Q8](#) [2021/APR1/Q7](#)  
[2021/JUL2/Q7](#) [2021/OCT/Q9](#) [2022/APR/Q8](#) [2022/JUL/Q9](#)

[Click Here to See the Answer](#)

## AUG - 2022

- Q1.a) Explain the meaning of the term power factor correction (4)  
b) State advantages of power factor correction (4)  
c) Explain, with the aid of a circuit diagram, how power factor correction can be effected in a three phase circuit using capacitors. (4)  
d) Explain one method other than the use of capacitors by means of which power factor correction may be effected. (4)

[2022/AUG/Q1](#)

[Click Here to See the Answer](#)

Q2. Describe how the starting torque of electric induction motors may be improved by using each of the following.

- a) Wound rotor (8)  
b) Double cage (8)

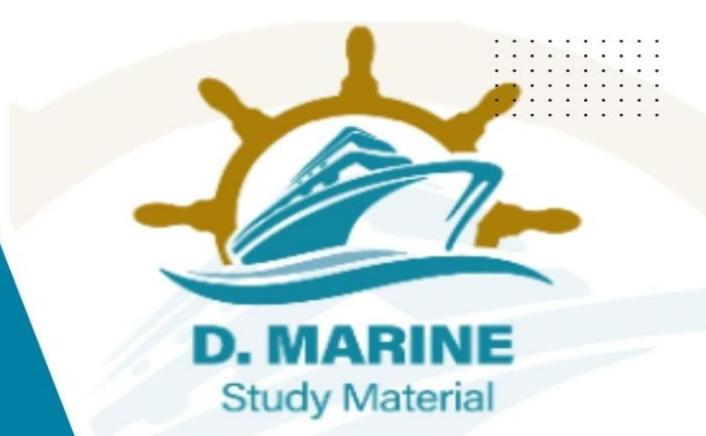
[2022/AUG/Q2](#)

[Click Here to See the Answer](#)

- Q3. a) Describe, with the aid of a sketch, an electronic soft starting system that may be used for large a.c. induction motors. (8)  
b) Discuss the advantages and disadvantages of soft starting system. (8)



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**2022/AUG/Q3**

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Q4. A) With reference to voltage variation profiles caused by load changes imposed on alternating current generators when starting large motors online:

- Sketch a voltage dip, showing an acceptable recovery time. (2)
- State salient factors that cause the variation in part (a) (3)
- Outline salient factors that assist recovery from the deviation shown in part (3)

B) A three-phase induction motor is wound for four poles and is supplied from a 50 Hz System calculate:

- The synchronous speed
- The speed of rotor when the slip is 4 per cent.
- The rotor frequency when the speed of the rotor is 600 r/min (8)

**2022/AUG/Q4**

[Click Here to See the Answer](#)

Q5. A) With reference to large electrical transformers on board ships:

- State where these transformers may be used (2)
  - State a typical efficiency range for a transformer (2)
  - State the protective devices that are fitted (2)
  - Describe the maintenance requirements (2)
- B) What are the losses in transformers? Mention the various factors which affect these losses. In a 25KVA, 3300/223 V, Single phase transformer, the iron and full load  $C_u$ . Losses are respectively 350 and 400 watts. Calculate the efficiency at half-full load, 0.8 power factor (8)

**2022/AUG/Q5**

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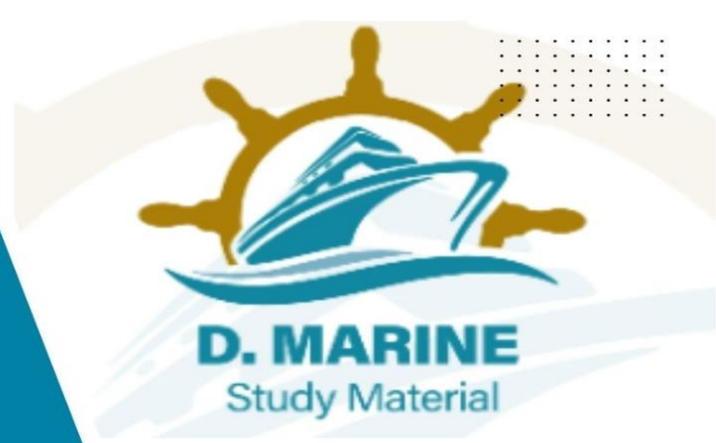
Q6. A total load of 8000 kW at 0.8 power factor is supplied by two alternators in parallel. One alternator supplies 6000kW at 0.9 power factor. Find the kVA rating of the other alternator and the power factor. (16)

**2022/AUG/Q6**

[Click Here to See the Answer](#)



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Q7.a) With reference to shipboard sewage treatment plants, describe the principle of operation of each of the following:

(i) Biological

(ii) Physical (8)

b) Explain why sewage systems involving aerobic action are to be preferred to those with anaerobic action

c) Explain the meaning and significance of biological oxygen demand (4)

**2022/AUG/Q7**

[Click Here to See the Answer](#)

Q8. With reference to the Maritime Labour Convention (MLC) 2006. Discuss the requirements for seafarers regarding: -

a) Minimum age to work onboard vessels (5)

b) Seafarers Employment agreements (5)

c) Hours of work and hours of rest. (6)

**2022/AUG/Q8**

[Click Here to See the Answer](#)

Q9. With reference to "ISM Code" write short notes on:

a) Masters Review (4)

b) Requirement and Advantages of Familiarization of seafarer onboard (4)

c) Designated Person Ashore (DPA) (4)

d) Functional requirements for a Safety Management System. (4)

**2022/AUG/Q8**

[Click Here to See the Answer](#)

### SEP - 2022

Q1. Differentiate with the aid of simple sketches between the following types of Electronic circuits.

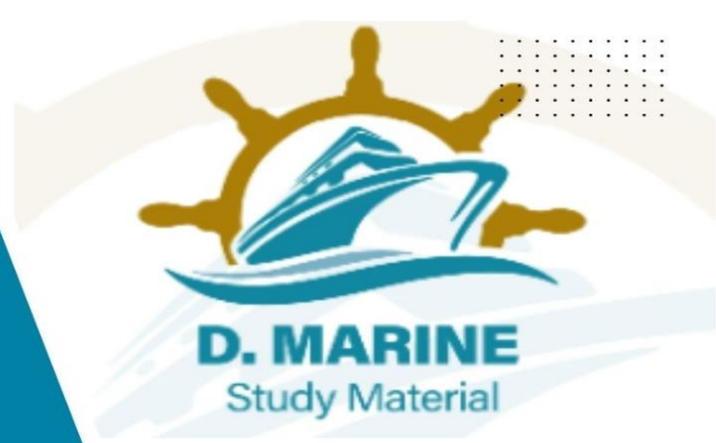
i) Rectifier circuit

ii) Amplifier circuit

iii) Oscillator circuit



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**2022/SEP/Q1**

[Click Here to See the Answer](#)

- Q2.a) Sketch a circuit for a basic d.c. voltage stabilisation circuit using a Zener diode and a series resistor.
- b) Sketch & describe the reverse current characteristic for a typical Zener diode.
- c) List the factors which determine the value of the series resistor in the circuit.
- d) List the factors that determine the power rating of the chosen Zener diode.

**2022/SEP/Q2**

[Click Here to See the Answer](#)

Q3. Discuss magnetic leakage in a Transformer, and indicate how its value may be kept down, show, by means of a vector diagram, how the voltage regulation of a transformer is influenced by its magnetic leakage.

**2022/SEP/Q3**

[Click Here to See the Answer](#)

- Q4. a) Describe the possible causes and the effect of running a three-phase motor with one phase open circuit. (6)
- b) A heater unit of inductance has a resistance of 6.5 ohms and is intended for use with 100V mains. For 50Hz what voltage would it be suitable when placed in series with an external apparatus, of negligible resistance, having an inductance of 0.01H? If the frequency rises by 5 per cent and this voltage remains constant, what would be the resulting change of voltage at the heater terminals? (10)

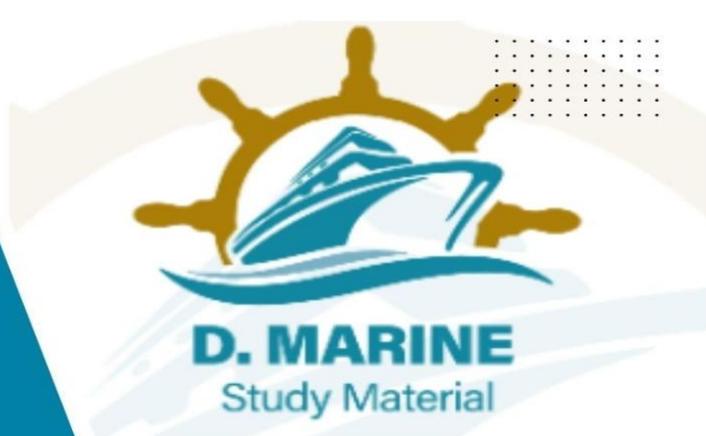
**2022/SEP/Q4**

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Q5. a) Explain the applications of PN junction diode (6)



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b) In a full wave rectifier without filter, the load resistance is  $4\text{ k}\Omega$ . Each diode has a forward resistance of  $0.8\text{ k}\Omega$ . If the peak voltage applied to each diode is  $120\text{ V}$  at  $50\text{ Hz}$ , calculate:

- (i) The average value of current.
- (ii) Efficiency and
- (iii) Regulation at a load current of  $10\text{ mA}$  (10)

**2022/SEP/Q5**

[Click Here to See the Answer](#)

Q6.a) Derive an expression for the emf induced in an a.c. generator. (6)

b) A  $3000\text{ KVA}$ , 6-pole alternator runs at  $1000\text{ r.p.m.}$  in parallel with other machines on  $3300\text{ V}$  bus-bars. The synchronous reactance is  $25\%$ . Calculate the synchronizing power for one mechanical degree of displacement and the corresponding synchronizing torque. (10)

**2022/SEP/Q6**

[Click Here to See the Answer](#)

Q7. With reference to oil monitoring of bilge and tanker ballast discharges:

- a) Describe with the aid of a sketch, the general arrangement of an oil monitoring system. (8)
- b) State the inputs that are recorded. (4)
- c) Explain the difficulties encountered with the efficient operation of the oil monitoring system. (4)

**2022/SEP/Q7**

[Click Here to See the Answer](#)

Q8. With reference to an automatic water sprinkler, fire detecting alarm and extinguishing system for accommodation spaces:

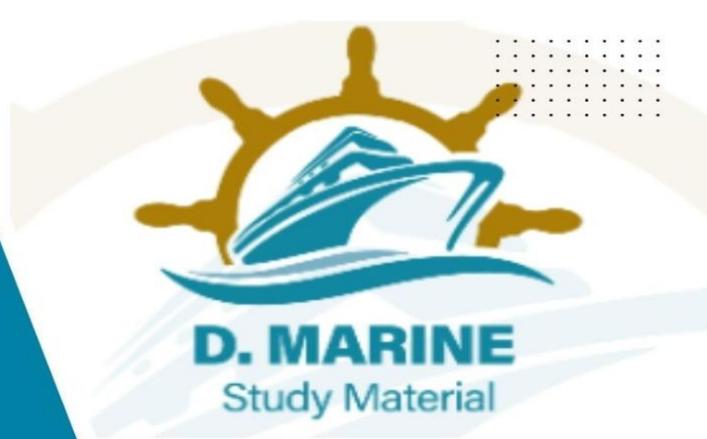
- a) Sketch a typical system. (4)
- b) Describe the operation of this system. (4)
- c) State the sources of water available. (2)
- d) Describe the sprinkler head and its operation. (3)
- e) State how the temperature rating of the sprinkler head is determined. (3)

**2022/SEP/Q8**

[Click Here to See the Answer](#)



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- Q9.a) Draw and Explain flammability diagram (4)  
b) What is critical dilution in flammability diagram? (4)  
c) How does inert gas reduce flammability range.  
d) Describe purging and gas freeing operation of cargo tank in Crude Oil Tanker. (4)

**2022/SEP/Q9**

[Click Here to See the Answer](#)

**OCT - 2022**

- Q1. a) Draw a circuit diagram of a transistor connected as a common emitter amplifier including Bias resistors, coupling and decoupling capacitors. (8)  
b) Explain the operation of the circuit components (8)

**2022/OCT/Q1**

[Click Here to See the Answer](#)

- Q2. With the aid of a block diagram, briefly describe the effect that negative voltage feedback has on an amplifier and state the advantages resulting from the use of negative feedback. (16)

**2022/OCT/Q2**

[Click Here to See the Answer](#)

- Q3. a) Sketch a main engine shaft driven generator arrangement with an electronic system for frequency correction. (8)  
b) Describe the operation of the generator arrangement sketched in (a). (8)

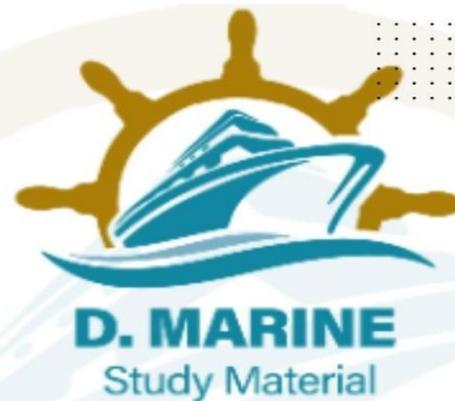
**2022/OCT/Q3**

[Click Here to See the Answer](#)

- Q4.a) List the factors that determine the starting torque of the three-phase induction motor. How does this torque generally compare with the value of the rated torque (6)



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b) An 18.65 KW, 6 Pole, 50 Hz, 3 phase slip ring induction motor runs at 960 rpm on full load with a rotor current per phase of 35 A allowing 1 KW for mechanical losses, find the resistance /phase of three- phase winding.

**2022/OCT/Q4**

[Click Here to See the Answer](#)

Q5.a) With the aid of delta and star connection diagrams, state the basic equation from which the delta -star and star- delta conversion equation can be derived (6)

b) A 230/115 V, single phase transformer is supplied with a load of 5A at p.f. 0.86 lagging. The no - load current is 0.2 A at p.f. 0.208 lagging. Calculate the primary current and p.f. (10)

**2022/OCT/Q5**

[Click Here to See the Answer](#)

Q6. A 3000 KVA, 6-pole 3 phase, star connected alternator runs at 1000 r.p.m. in parallel with other machines on 3300V bus-bars. The synchronous reactance is 25%. Calculate the synchronizing power for one mechanical degree of displacement and the corresponding synchronizing torque. (16)

**2022/OCT/Q6**

[Click Here to See the Answer](#)

Q7. Describe the pumping of machinery space bilges and disposal of oil/sludge residues of your ship using the following guidelines:

a) When outside the twelve mile limit and not in a special area: (4)

b) Inside the twelve mile limit and in special areas (4)

c) For logging the discharges; (4)

d) The disposal of oily residues for vessels with no incinerator (4)

**2022/OCT/Q7**

[Click Here to See the Answer](#)

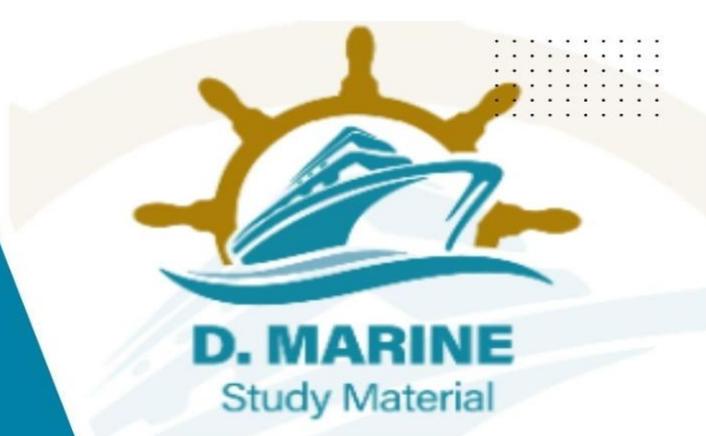
Q8. With references to the pump room of an oil tanker describe the following with particular emphasis on safety aspects:

a) Ventilation system (5)

b) Procedure to be followed for pump room entry. (6)



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c) Lighting system. (5)

**2022/OCT/Q8**

[Click Here to See the Answer](#)

Q9. With reference to “ISM Code” write short notes on:

a) Objectives of the ISM code; (4)

b) Resource and personnel; (4)

c) Masters Authority and responsibility; (4)

d) Functional requirements for a safety management system. (4)

**2022/OCT/Q9**

[Click Here to See the Answer](#)

### NOV - 2022

Q1. a) Explain why it is necessary to have reverse power protection for alternators intended for operation. (6)

b) (i) Sketch a reverse power trip. (5)

(ii) Briefly explain the principle on which the operation of this power trip is based and how tripping is activated. (5)

**2021/JAN/Q2** **2022/FEB/Q3** **2022/NOV/Q1**

[Click Here to See the Answer](#)

Q2. List the factors that cause deterioration of the frequency response of a transistor amplifier. Explain how each factor affects the performance of the amplifier and the portion of the frequency range where it is effective. (16)

**2022/NOV/Q2**

[Click Here to See the Answer](#)

Q3. a) What are the causes of overheating of an induction motor (4)

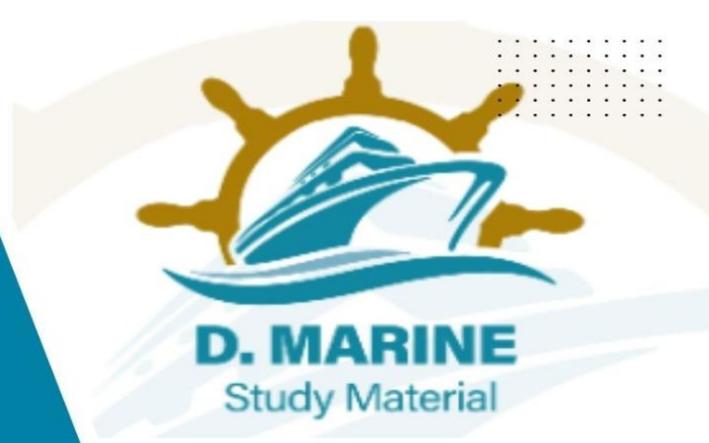
b) What preventive measures are provided against damage to an induction motor in installed condition.

c) What is the purpose of “fuse back up protection” provided to an induction motor (3)

d) How does an induction motor develop torque? (3)



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e) What is the condition to be satisfied for achieving maximum running torque in an induction motor?

**2022/NOV/Q3**

[Click Here to See the Answer](#)

Q4.a) Explain what is meant by the terms wave form , frequency, and average value. (6)

b) A moving coil ammeter, a thermal ammeter and a rectifier are connected in series with a resistor across 110 V sinusoidal a.c. supply. The circuit has a resistance of  $50\Omega$  to current in one direction and, due to the rectifier, an infinite resistance to current in the reverse direction. Calculate

(i) The reading on the ammeters

(ii) The form and peak factors of the current wave (10)

**2022/NOV/Q4**

[Click Here to See the Answer](#)

Q5. a) What is leakage flux as it applies to the iron-core transformer? How is it taken into account in the analysis of the transformer? (6)

b) The following results were obtained on a 50 kVA transformer: open circuit test-primary voltage, 3300 V; Second voltage, 415 V: primary power, 430 W. Short circuit test-primary voltage, 124 V: primary current, 15.3 A; primary power, 525 W; secondary current, to be assumed at full load value. Calculate:

(i) The efficiencies at full load and at half load for 0.7 power factor.

(ii) The voltage regulations for power factor 0.7 (i) lagging, (ii) leading

(iii) The secondary terminal voltages corresponding to (i) and (ii) (10)

**2022/NOV/Q5**

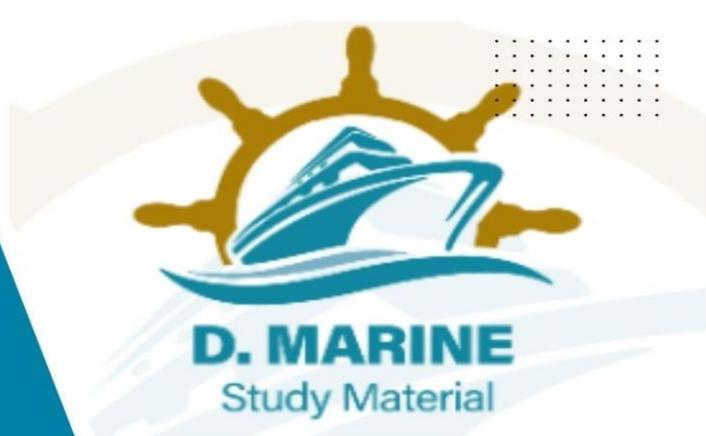
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Q6. a) What is a silicon-controlled rectifier (SCR)? How is the breakover voltage of the SCR defined?

b) A d.c. motor takes an armature current of 110 A at 480 V. the resistance of the armature circuits is  $0.2\Omega$ . The machine has six poles and the armature is lap-connected with 864 conductors. The flux per pole is 0.05 Wb. Calculate



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- a) The speed:
- b) The gross torque developed by the armature. (10)

**2022/NOV/Q6**

[Click Here to See the Answer](#)

- Q7. a) State the hazards which may be encountered when entering an enclosed space and the precautions that should be taken. (5)
- b) Sketch and describe an oxygen analyser which can be used to sample the atmosphere in void or closed spaces. (5)
- c) Instruction given to person entering the enclosed space as per the ISM procedures. (6)

**2022/NOV/Q7**

[Click Here to See the Answer](#)

Q8. With reference to fire smothering agents explain why:

- a) Effectiveness of foam is directly related to its degree of effervescence and surface tension. (6)
- b) low expansion foam is best suited for use against localized fire, while high expansion foam is most effective in with major conflagrations,
- c) In the absence of foam appliances, water jets can be effectively used against oil fires (5)

**2022/NOV/Q8**

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Q9. With reference to MARPOL Annex I:

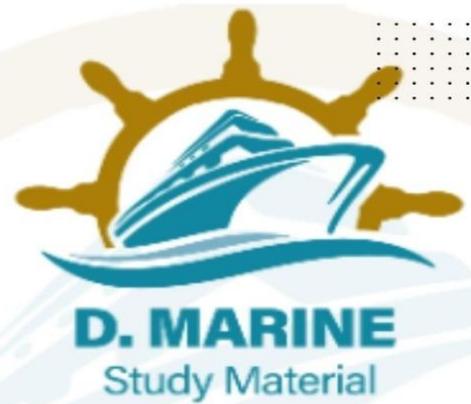
- a) Draw a 15 ppm oily water separator and explain the principles of operation (8)
- b) Periodical maintenance and checks tests required to be done to verify the effectiveness of the above system. (8)

**2020/FEB/Q8** **2021/FEB/Q9** **2022/NOV/Q9**

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## DEC - 2022

Q1. a) Sketch a main engine shaft driven generator arrangement with an electronic system for frequency correction. (8)

b) Describe the operation of the generator arrangement sketched in (a). (8)

**2022/OC T /Q3** **2022/DEC /Q1**

[Click Here to See the Answer](#)

Q2. It is proposed to operate a bow thrusters' unit from a 3.3 KV electrical supply online suitable option for the design of installation under each of the following heading.

a) Protection of main switch board:

b) Overload of a bow thrusters motor:

c) Cable Protection. (16)

**2022/DEC /Q2**

[Click Here to See the Answer](#)

Q3. Explain the matching of an induction electric motor to a pump required for main circulating duty, with the aid of pump characteristic and torque/ship diagrams (16)

**2022/DEC /Q3**

[Click Here to See the Answer](#)

Q4. a) Why is it important to maintain high efficiency of operation? And low values of voltages regulation for power transformers? (6)

b) A shunt motor supplied at 230 V runs at 900 rpm. When the armature current is 30 A, the resistance of the armature circuit is  $0.4 \Omega$ . Calculate the resistance required in series with the armature circuit to reduce the speed to 500 rpm. Assume that the armature current is 25 Amps. (10)

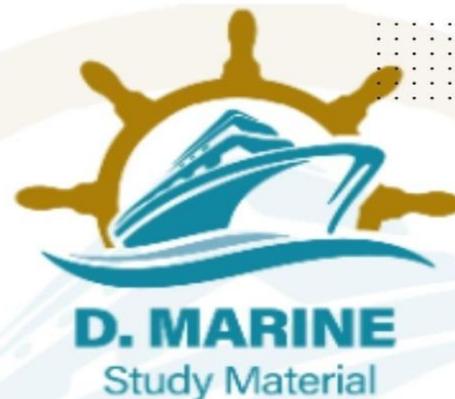
**2022/DEC/Q4**

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Q5. a) What is back emf? Derive the relation for the back emf and the supplied voltage in terms of armature resistance (6)



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b) The earth-lamps on a main switchboard comprise two 240 V 60 W lamps connected in the usual manner. The potential difference at the busbars is 220 V. Damage by sea water occurs to a distribution cable so that the insulation resistance to the earth is reduced to 16 ohms and 6 ohms for +ve and -ve cables respectively. Find by calculation:

a) Which of the two lamps burns the brighter:

b) The additional load on the generators occasioned by the fault. The resistance of the cables and the ship's structure may be neglected, and that of the lamps taken as constant at the value corresponding to the 60 W rating. (10)

**2022/DEC/Q5**

[Click Here to See the Answer](#)

Q6.a) Derive an expression for the emf induced in an a.c. generator . (6)

b) A 3000 KVA, 6-pole alternator runs at 1000 r.p.m. in parallel with other machines on 3300V bus- bars. The synchronous reactance is 25%. Calculate the synchronizing power for one mechanical degree of displacement and the corresponding synchronizing torque. (10)

**2022/SEP/Q6** **2022/DEC/Q6**

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Q7. Explain the following terms / statement:

a) SEEMP.

b) Special Area as defines in MARPOL 73/78

c) EEDI /EEOI (16)

**2022/DEC /Q7**

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Q8. With Reference to the Maritime Labour Convention (MLC) 2006, discuss the requirements for seafarers regarding:

a) Seafarers Employment Agreements.

b) Repatriation

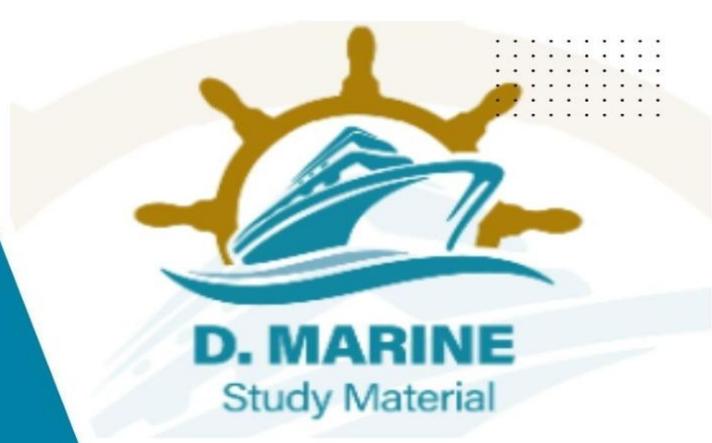
c) Seafarers Wages. (16)

**2022/DEC/Q8**

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Q9. Write reference to gravity lifeboat davits; state the purpose of the following:

- a) Centrifugal brake.
- b) Dead man's handle.
- c) Davit limit switch. (16)

**2022/DEC/Q9**

[Click Here to See the Answer](#)

