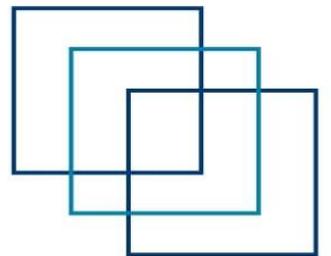




# ELECTRO TECHNICAL OFFICER : WRITTEN

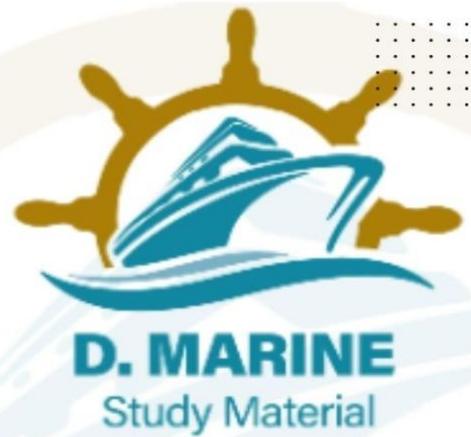
FOR INDIAN COMPETENCY EXAM



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## JAN - 2021

Q1. 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**

[Click Here to See the Answer](#)

Q2. 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**

[Click Here to See the Answer](#)

Q3. a) Write a short note on the principle of operation of induction motors

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

c) If a 4-pole motor is supplied at 60Hz and runs with a slip of 5%. What is the actual rotor speed? (4)

**2021/JAN/Q3**

[Click Here to See the Answer](#)

Q4. With Respect to PLC's used onboard ships:

a) Draw and explain the block diagram of a PLC? (8)

b) Name the onboard ship equipment where PLC's are used (4)

c) What are the advantages of PLC controllers over other type of controllers. (4)

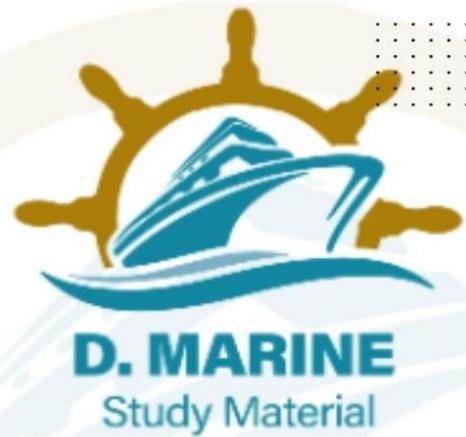
**2020/FEB/Q4** **2021/JAN/Q4**

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Q5. With respect to circuit breakers:



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- 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)

**2021/JAN/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**

[Click Here to See the Answer](#)

Q7. With reference to MARPOL Annex IV

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

**2019/DEC/Q9** **2020/OCT/Q7** **2021/JAN/Q7**

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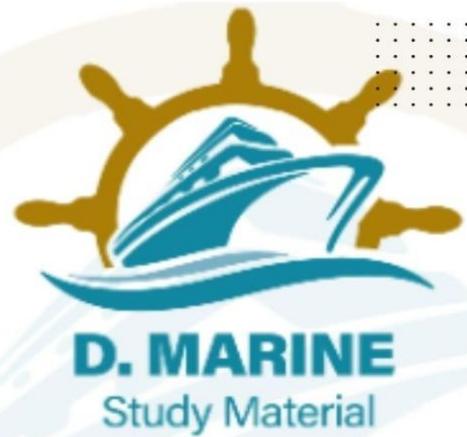
Q8. With reference to entry into enclosed spaces onboard:

- 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**



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[Click Here to See the Answer](#)

- Q9. a) Describe CO<sub>2</sub> Fixed firefighting system for machinery spaces and cargo spaces of a bulk carrier.  
b) Explain safety precautions taken prior to release of CO<sub>2</sub> to the engine room. (8)

**2021/JAN/Q9**

[Click Here to See the Answer](#)

**FEB – 2021**

- Q1. Explain the principle of operation of synchronous Motors with a simple sketch. Where are synchronous motor used onboard? (16)

**2020/MAR/Q1** **2021/FEB/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**

[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**

[Click Here to See the Answer](#)

- Q4. With Respect to PLC's used onboard ships:

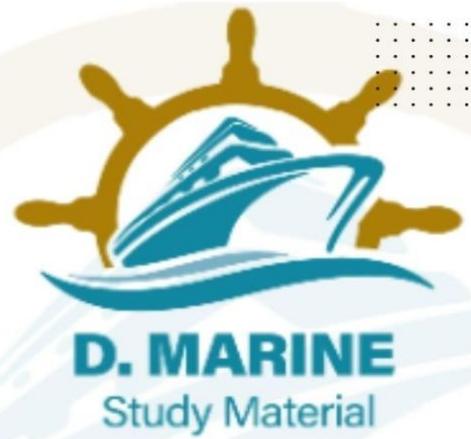
- a) Draw and explain the block diagram of a PLC? (8)  
b) Name the onboard ship equipment where PLCs are used (4)  
c) What are the advantages of PLC controllers over other type of controllers. (4)

**2020/FEB/Q4** **2021/JAN/Q4** **2021/FEB/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)? (6)

**2019/MAR/Q3** **2021/FEB/Q5**

[Click Here to See the Answer](#)

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)

**2019/DEC/Q6** **2021/FEB/Q6**

[Click Here to See the Answer](#)

Q7. a) Briefly describe the step by step procedure that was followed before the release of CO<sub>2</sub> in engine room, in case of engine room fire (8)

b) What means are provided to prevent inadvertent release of CO<sub>2</sub> in engine room? (8)

**2020/MAR/Q8** **2020/OCT/Q8** **2021/FEB/Q7**

[Click Here to See the Answer](#)

Q8. With respect to the hazardous areas of tankers.

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

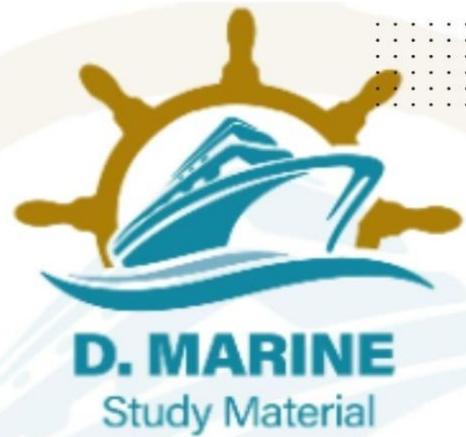
(c) List likely defects of flameproof equipment. (5)

**2020/MAR/Q9** **2020/OCT/Q9** **2021/FEB/Q8**

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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**

[Click Here to See the Answer](#)

#### MAR – 2021

Q1. With reference to an emergency source of electrical power in cargo ships: -

- a) Describe a typical power source. (8)
- b) Give a typical list of essential services, which must be supplied simultaneously. Explain how the emergency installation can be periodically tested. (8)

**2019/JUL/Q1** **2019/DEC/Q3** **2021/MAR/Q1**

[Click Here to See the Answer](#)

Q2. Sketch and describe a main engine shaft driven generator arrangement with an electronic system for frequency correction. (16)

**2019/OCT2/Q5** **2019/DEC/Q4** **2021/MAR/Q2**

[Click Here to See the Answer](#)

Q3. With Respect to Insulated and Earthed Neutral Systems used on board:

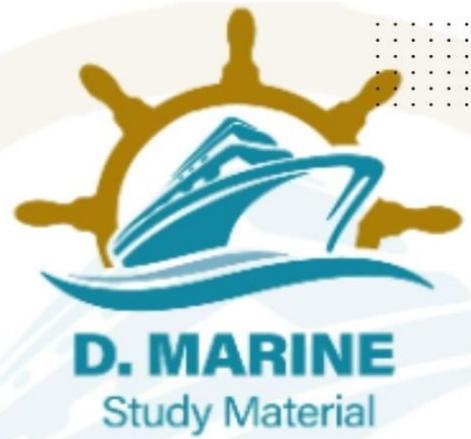
- a) Discuss the Advantages and Disadvantages of both Insulated and Earthed Systems used on board.
- b) Discuss the consequences of earth fault in an earthed distribution system. (4)
- c) What would be the Ohmic value of the NER to limit the earth fault to the full load rating of a 2 MW, 0.8 pf, 3.3KV, 3Phase A.C. generator? (4)

**2019/APR/Q1** **2020/OCT/Q4** **2020/DEC/Q1** **2021/MAR/Q3**

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Q4. a) Describe the different type of losses occurring in the power Transformers. (4)

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

(i) The efficiency

(ii) If the load is now changed to 30 KVA at a p.f of 0.91 (lagging). Calculate the new efficiency.

**2019/APR/Q3** **2020/OCT/Q5** **2021/MAR/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)

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

**2021/MAR/Q5**

[Click Here to See the Answer](#)

Q6. A) Explain the significance of the root-mean-square value of an alternating current or voltage waveform. Define the form factor of such a waveform. (6)

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

**2021/MAR/Q6**

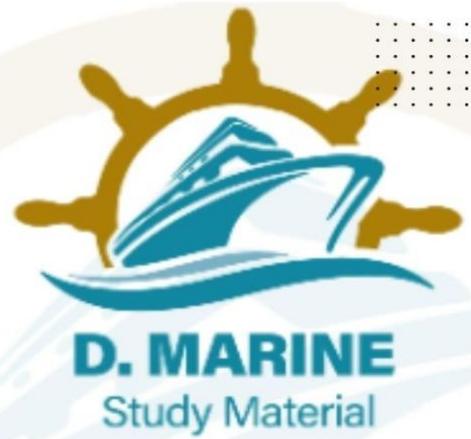
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Q7. With reference to entry into enclosed spaces onboard:

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



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- 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)

2019/APR/Q7 2019/JUN/Q8 2019/JUL/Q8 2019/SEP/Q8  
2019/OCT1/Q7 2020/MAR/Q7 2021/JAN/Q8 2021/MAR/Q7

[Click Here to See the Answer](#)

Q8. 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)

2019/JAN/Q8 2019/APR/Q8 2019/JUL/Q9 2019/DEC/Q7  
2021/MAR/Q8

[Click Here to See the Answer](#)

Q9. With reference to MARPOL Annex IV

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

2020/OCT/Q7 2021/JAN/Q7 2021/MAR/Q9

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#### APR - 2021 SET -1

Q1. 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

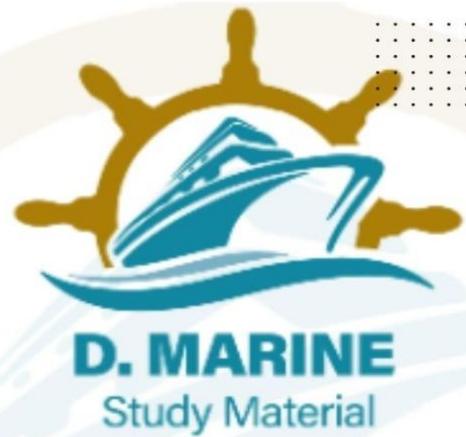
[Click Here to See the Answer](#)

Q2. Briefly explain the principle of Operation of induction Motors (4)

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



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

**2019/SEP/Q2** **2019/OCT1/Q1** **2021/APR1/Q2**

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Q3. a) What precautions must be taken when testing the insulation of generator cables and wiring connected to an AVR unit? (6)

b) If synchroscope is malfunctioning, which instrument is the most essential to parallel an alternator with the busbar? Justify your answer (6)

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

**2021/APR1/Q3**

[Click Here to See the Answer](#)

Q4. 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**

[Click Here to See the Answer](#)

Q5. A shunt generator has an induced emf of 254 V. When the generator is loaded, the terminal voltage is 240 V, Neglecting armature reaction, find the load current if the armature resistance is 0.04 ohm and the field circuit resistance is 24 ohms. (16)

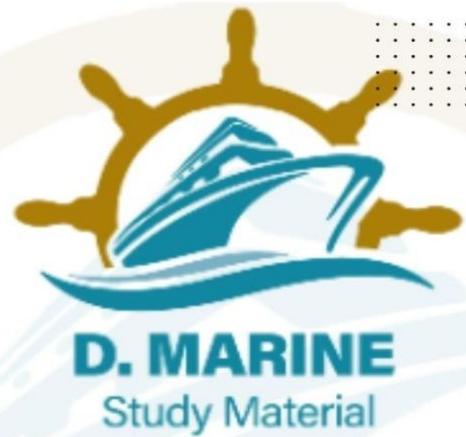
**2021/APR1/Q5**

[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



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lagging power factor at its low voltage side, determine the primary current and its power factor. Ignore leakage impedance drop. (16)

**2019/SEP/Q6** **2020/MAR/Q6** **2021/JAN/Q6** **2021/APR1/Q6**

[Click Here to See the Answer](#)

Q7. 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)

**2019/JUN/Q9** **2019/SEP/Q9** **2020/MAR/Q9** **2020/OCT/Q9**

**2021/FEB/Q8** **2021/APR1/Q7**

[Click Here to See the Answer](#)

Q8. a) Describe CO<sub>2</sub> Fixed fire fighting system for machinery spaces and cargo spaces of a bulk carrier.

b) Explain safety precautions taken prior to release of CO<sub>2</sub> to the engine room. (8)

**2021/JAN/Q9** **2021/APR1/Q8**

[Click Here to See the Answer](#)

Q9. a) Sketch and describe hydraulic circuit of steering gear incorporating automatic isolation system.

b) Explain 'Emergency steering' (4)

c) Describe the routine tests of steering gear as per SOLAS requirement. (4)

**2021/APR1/Q9**

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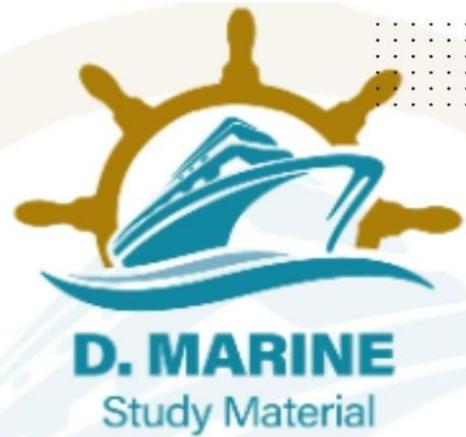
## APR - 2021 SET - 2

Q1. 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.



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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**

[Click Here to See the Answer](#)

Q2. 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**

[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)

**2019/OCT2/Q1** **2020/MAR/Q2** **2020/OCT/Q2** **2020/DEC/Q2**

**2021/FEB/Q3** **2021/APR2/Q3**

[Click Here to See the Answer](#)

Q4. With Respect to PLC's used onboard ships:

a) Draw and explain the block diagram of a PLC? (8)

b) Name the onboard ship equipment where PLC's are used (4)

c) 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**

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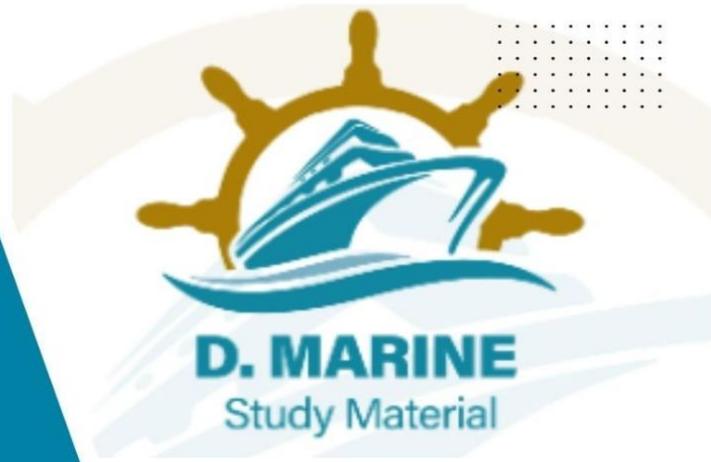
Q5. A 400V, 4-pole, 50 Hz, 3-phase, 10 hp, star connected induction motor has a no load slip of 1% and full load slip of 4%, find the following:

(i) Syn speed

(ii) No -load speed



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- (iii) Full load speed
- (iv) Frequency of rotor current at full load
- (v) Full - load torque (16)

**2021/APR2/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 3 $\phi$  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.

**2018/NOV/Q3** **2019/JAN/Q2** **2019/APR/Q2** **2021/APR2/Q6**

[Click Here to See the Answer](#)

- 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)

**2019/SEP/Q7** **2019/OCT2/Q9** **2020/FEB/Q9** **2020/DEC/Q9**

**2021/APR2/Q7**

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Q8. With reference to entry into enclosed spaces onboard:

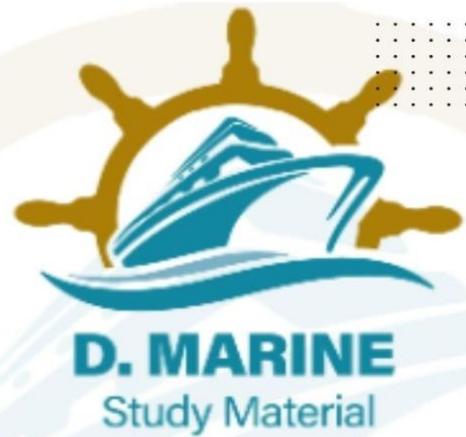
- a) Define “Enclosed space” and give example of enclosed spaces onboard
- b) Describe the checks done for testing the atmosphere inside such enclosed spaces. (5)
- c) Explain safety precautions taken prior to entry into enclosed spaces onboard vessel. (5)

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

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Q9. With Respect to MARPOL, Annex V:

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

**2018/NOV/Q7** **2021/APR2/Q9**

[Click Here to See the Answer](#)

#### JUN - 2021

Q1. With Respect to Insulated and Earthed Neutral Systems used on board:

- Discuss the Advantages and Disadvantages of both Insulated and Earthed Systems used on board.
- What is earth fault and how do you identify Earth fault in the 440 V system onboard. (4)
- Discuss the consequences of earth fault in an earthed distribution system. (4)

**2020/DEC/Q1** **2021/JUL/Q1**

[Click Here to See the Answer](#)

Q2.a) Explain three methods of overcurrent protection for electrical circuit. (8)

- 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**

[Click Here to See the Answer](#)

Q3. a) What are safeties incorporated in ABC of ship's generator and prime mover? (10)

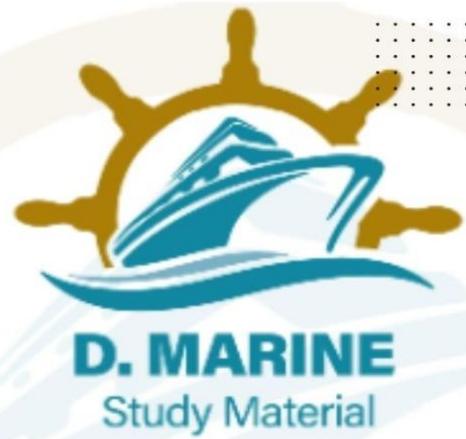
- Explain the procedure to test reverse power relay (6)

**2020/FEB/Q5** **2021/JUL/Q3**

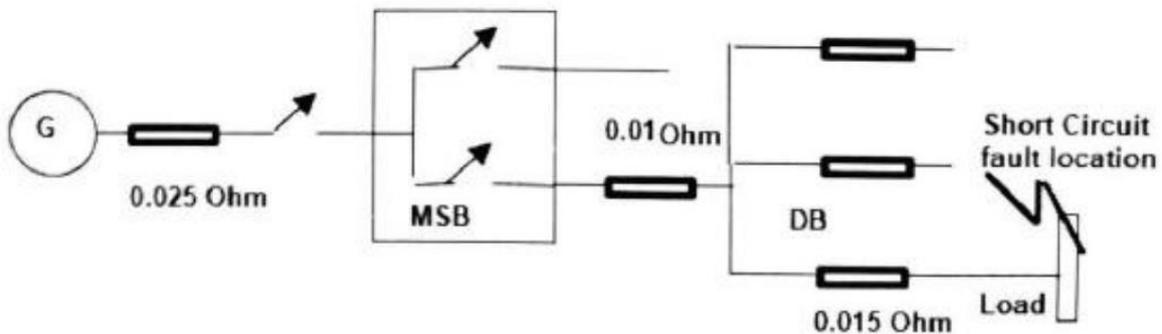
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Q4. a) A 440 V, 10KW 0.8 pf phase load is supplied as shown.  
Calculate short circuit fault current at the load and at the main switch board



b) Explain the safe working procedure that you will follow while working in live MSB bus bar. (8)

**2021/JUL/Q4**

[Click Here to See the Answer](#)

Q5. 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)

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

[Click Here to See the Answer](#)

Q6. With Reference to different types of transformers used onboard.

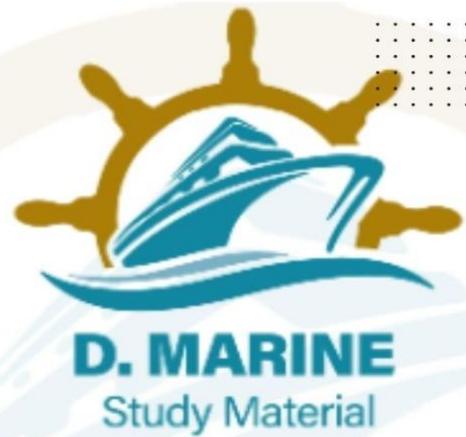
- Discuss the basic principle of operation of a transformer (5)
- Enumerate the different types of transformers used onboard also state their functions for which they are used. (5)
- A 440/110 V single phase transformer supplies a load of 5KW at 0.8 power factor load. Calculate the primary and secondary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

**2018/OCT/Q1** **2019/MAR/Q3** **2021/FEB/Q5** **2021/JUL/Q6**

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- Q7.a) What are the potential hazards associated with working on an engine room crane at a height? (5)  
b) What is risk assessment? What risk mitigation measures will you take to mitigate the hazards identified by you while working at height? (6)  
c) With reference to Q7 (a), what checklists and permits will you fill up before commencing the work and who will authorize the work permits? (5)

**2021/JUL/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**

[Click Here to See the Answer](#)

Q9. With Reference to Electrical Safety onboard a vessel:

- a) Write Short note on "Electric Shock" (6)

[Click Here to See the Answer](#)

### JULY - 2021

- Q1. Explain the principle of operation of synchronous Motors with a simple sketch. Where are synchronous motor used onboard? (16)

**2020/MAR/Q1** **2021/FEB/Q1** **2021/JUL2/Q1**

[Click Here to See the Answer](#)

- 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)

**2019/OCT2/Q1** **2020/MAR/Q2** **2020/OCT/Q2** **2020/DEC/Q2**

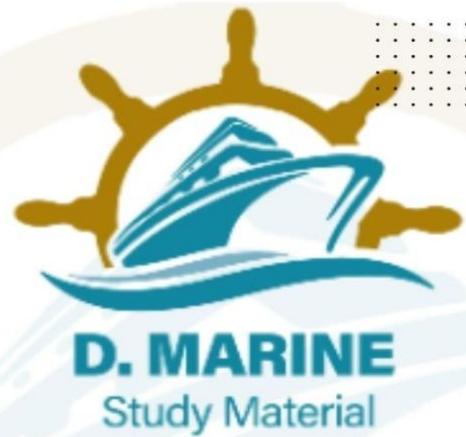
**2021/FEB/Q3** **2021/APR2/Q3** **2021/JUL/Q2** **2021/APR1/Q2**

**2021/JUL2/Q2**

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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)

**2019/OCT2/Q3** **2020/FEB/Q1** **2021/JAN/Q1** **2021/JUL2/Q3**

[Click Here to See the Answer](#)

Q4. a) Describe the working of a single-phase full wave rectifier with a resistive load. Draw the load voltage and current waveforms. (8)

b) Diode half wave rectifier supply a resistive load of  $100\Omega$  from a 100 V ac r.m.s voltage source. The diode is a resistance of  $5\Omega$  during conduction state. Calculate

i) The DC output voltage

ii) DC average load current (8)

**2019/JAN/Q6** **2019/APR/Q6** **2019/JUL/Q4** **2020/OCT/Q6**

**2021/APR1/Q4** **2021/JUL2/Q4**

[Click Here to See the Answer](#)

Q5. A) Explain three methods of overcurrent protection for electric circuit

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,

(i) the impedance (4)

(ii) the power factor (3)

(iii) the power absorbed. (3)

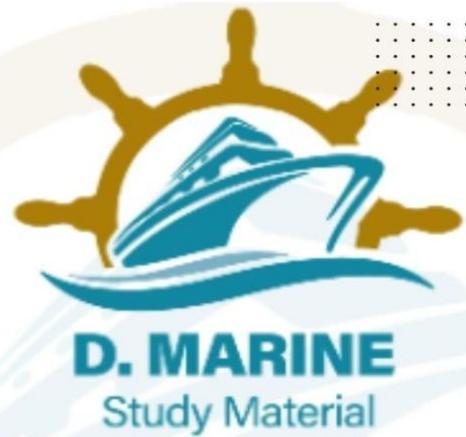
**2021/JUL2/Q5**

[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)



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

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### SECTION - III

Q7. 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)

**2020/OCT/Q7** **2021/JAN/Q7** **2021/MAR/Q9** **2021/JUL2/Q7**

[Click Here to See the Answer](#)

- Q8. a) Briefly describe the step by step procedure that was followed before the release of CO<sub>2</sub> in engine room, in case of engine room fire (8)
- b) What means are provided to prevent inadvertent release of CO<sub>2</sub> in engine room? (8)

**2020/MAR/Q8** **2020/OCT/Q8** **2021/FEB/Q7** **2021/JUL2/Q8**

[Click Here to See the Answer](#)

Q9. With respect to the hazardous areas of tankers.

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

**2020/MAR/Q9** **2020/OCT/Q9** **2021/FEB/Q8** **2021/APR1/Q7**

**2021/JUL2/Q9**

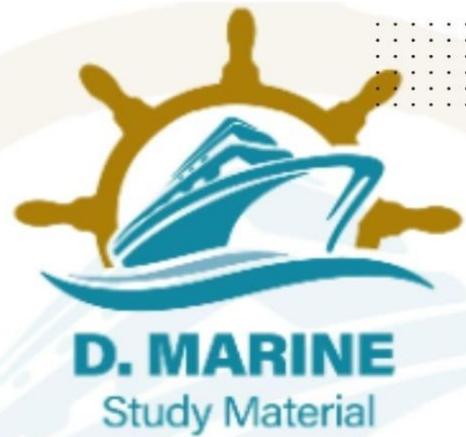
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### SEP - 2021

- Q1. A) Discuss the criteria of the classification of marine high voltage for A.C. and D.C. Systems. Sketch a Ships high voltage distribution system and explain its features. (8)
- b) Discuss the various methods of testing the insulation of HV system, Mention the significance of PI



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test, why 3 terminals insulation testers are used in HV insulation measurements (8 ).

2021/SEP/Q1

Q2. a) Explain briefly about checks and calibration of a thermostat which is used to stop an air compressor, when cooling water temperature goes too high? (8)

b) what is the significance of earth faults in an isolated neutral system? Explain with a suitable diagram.

**2021/SEP/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**

[Click Here to See the Answer](#)

## SECTION - II

Q4. 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

(ii) No -load speed

(iii) Full load speed

(iv) Frequency of rotor current at full load

(v) Full - load torque (16)

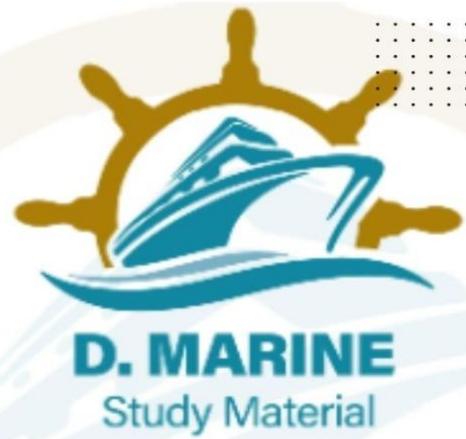
**2021/APR2/Q5** **2021/SEP/Q4**

[Click Here to See the Answer](#)

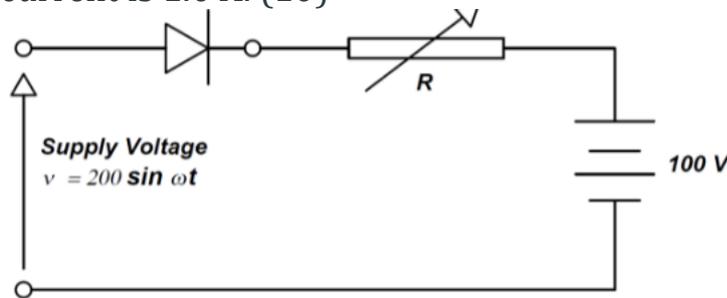
Q5. A) By means of a schematic circuit diagram illustrate the peak rectifier. If the supply voltage is  $v(t) = V_m \sin \omega t$ , what is the voltage across the load resistor? (6)



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b) A battery-charging circuit is shown below in fig. The forward resistance of the diode can be considered negligible and the reverse resistance infinite. The internal resistance of the battery is negligible. Calculate the necessary value of the variable resistance  $R$  so that the battery charging current is 1.0 A. (10)



2021/SEP/Q5

[Click Here to See the Answer](#)

Q6. A) Explain the significance of the root-mean-square value of an alternating current or voltage waveform. Define the form factor of such a waveform. (6)

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

2021/MAR/Q6 2021/SEP/Q6

### SECTION - III

Q7. a) Explain working of galley CO<sub>2</sub> firefighting control system (8)

b) sketch circuit diagram and explain working of electrical oven fitted in a ship's galley. (8)

2021/SEP/Q7

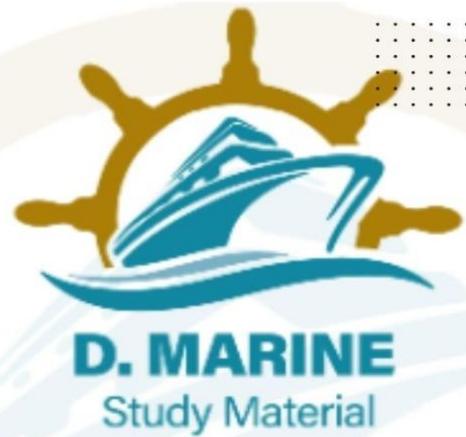
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Q8.a) With reference to working on Desk Cargo crane, what are the hazards associated with working at heights?

b) What risk mitigation measures will you take to mitigate the hazards identified in Q8 (a) while working at heights? (6)



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c) What is risk assessment? what all checklists and permits will you fill up before commencing the work on Deck cargo crane and who will authorize the permits? (5)

**2021/APR1/Q8** **2021/SEP/Q8**

[Click Here to See the Answer](#)

Q9. 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**

[Click Here to See the Answer](#)

### OCT - 2021

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**

[Click Here to See the Answer](#)

Q2. With reference to a three-phase shipboard electrical distribution system:

a) Enumerate the advantages of an insulated neutral system. (4)

b) Enumerate the disadvantages of an insulated neutral system. (4)

c) Describe how the Earthed neutral system is earthed. (4)

d) Compare the use of an insulated neutral system as opposed to the use of an Earthed neutral system with regard to the risk of electric shock from either system. (4)

**2020/MAR/Q4** **2021/OCT/Q2**

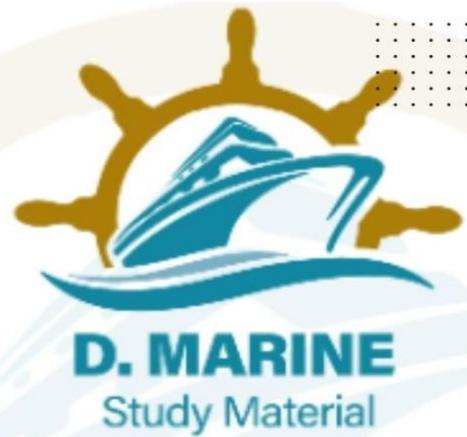
[Click Here to See the Answer](#)

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)



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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		

### SECTION - II

Q4. (a) Explain the principle of a Transformer? Discuss the various types of transformers used onboard?

(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

[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)

2019/OCT1/Q5	2020/MAR/Q5	2020/DEC/Q5	2021/MAR/Q5
2021/OCT/Q5			

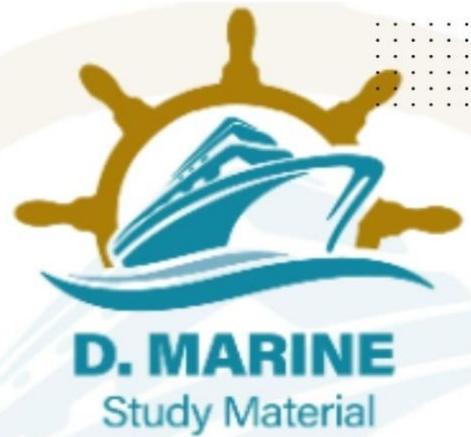
[Click Here to See the Answer](#)

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			



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### SECTION - III

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)

2019/SEP/Q8 2019/OCT1/Q7 2020/MAR/Q7 2021/JAN/Q8  
2021/MAR/Q7 2021/APR2/Q8 2021/OCT/Q7

[Click Here to See the Answer](#)

- Q8. a) Briefly describe the step by step procedure that was followed before the release of CO<sub>2</sub> in engine room, in case of engine room fire (8)
- b) What means are provided to prevent inadvertent release of CO<sub>2</sub> in engine room? (8)

2020/MAR/Q8 2020/OCT/Q8 2021/FEB/Q7 2021/JUL2/Q8  
2021/OCT/Q8

[Click Here to See the Answer](#)

Q9. With respect to the hazardous areas of tankers.

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

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

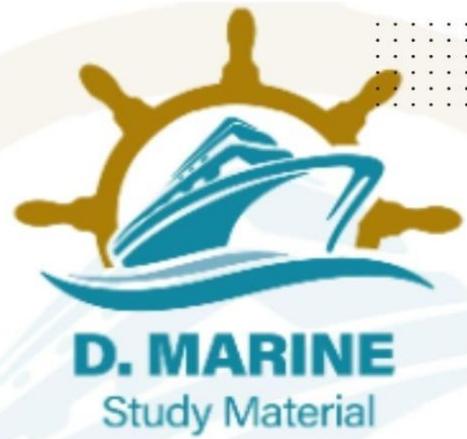
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### NOV - 2021

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



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- 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**

[Click Here to See the Answer](#)

Q2. Explain with the help of a neat diagram the operation of a brushless alternator. What would likely happen if one of the rotating Diode fails and becomes: (16)

- a) An open circuit?  
b) A short circuit?

**2020/FEB/Q2** **2020/DEC/Q4** **2021/NOV/Q2**

[Click Here to See the Answer](#)

Q3. 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)

**2021/MAR/Q8** **2021/NOV/Q3**

## SECTION- II

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) 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)

**2019/JAN/Q1** **2019/APR/Q1** **2020/OCT/Q4** **2020/DEC/Q1**

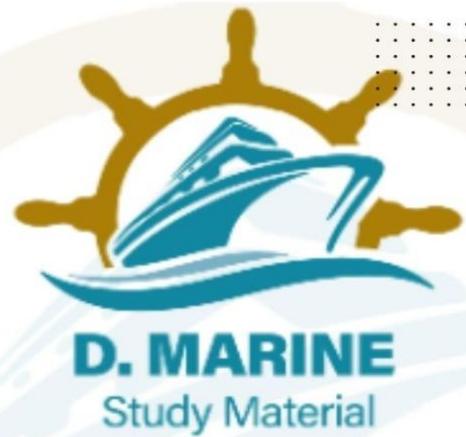
**2021/MAR/Q3** **2021/APR2/Q1** **2021/JUL/Q1** **2021/NOV/Q4**

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



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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/OCT1/Q5 2020/MAR/Q5 2020/DEC/Q5 2021/MAR/Q5

2021/OCT/Q5 2021/NOV/Q5

Q6. Two  $220 V$  d.c. generators each having linear external characteristics, operated in parallel one machine has a terminal voltage of  $270 V$  on no load and  $220V$  at a load current of  $35 A$ , while the other has a voltage of  $280 V$  at no load and  $220V$  at  $50 A$ . calculate the output current of each machine and the bus bar voltage when the total load is  $60 A$ . what is the kw output of each machine under this condition. (16)

2018/AUG/Q4 2018/NOV/4 2021/NOV/Q6

[Click Here to See the Answer](#)

### SECTION - III

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

2021/OCT/Q7 2021/NOV/Q7

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Q8. With Reference to Electrical Safety onboard a vessel:

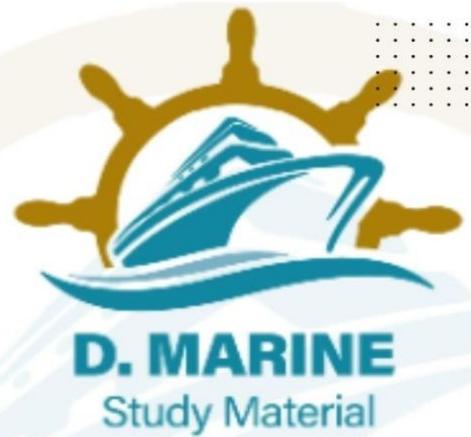
a) Write Short note on "Electric Shock" (6)

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)



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**2019/OC T1/Q8** **2019/OC T2/Q7** **2019/DEC/Q8** **2020/DEC/Q8**  
**2021/JUL /Q9** **2021/N OV/Q8**

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Q9. With the aid of suitable line diagram, sketch and describe a suitable (MGPS) Marine growth protection system installed on vessels to prevent fouling of internal sea water system. Specify the safety precautions you will take while carrying out maintenance on Marine growth protection system.

**2018/NOV/Q5** **2019/JAN/Q4** **2019/APR/Q4** **2021/NOV/Q9**

### DEC – 2021

Q1. Tank liquid level sensors are an integral part of ships. Describe with the aid of suitable sketches the working principle of:

- (a) Capacitive type level sensor (6)
- (b) Ultrasonic level sensor (5)
- (c) Float (5)

**2021/DEC/Q1**

[Click Here to See the Answer](#)

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/APR2/Q3** **2021/JUL/Q2** **2021/APR1/Q2** **2021/JUL2/Q2**  
**2021/OCT/Q3** **2021/DEC/Q2**

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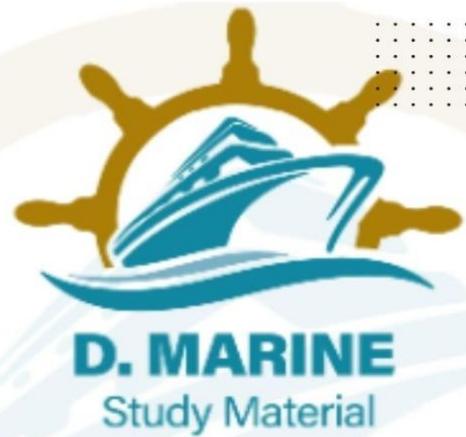
Q3. Sketch a circuit diagram for an automatic voltage regular illustrating how the A.V.R utilizes a silicon - controlled rectifier to control the excitation system for an alternator. Describe how the A.V.R monitors output and controls the excitation system. (16)

**2021/DEC/Q3**

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## SECTION - II

Q4. a) Describe the working of a single-phase full wave rectifier with a resistive load. Draw the load voltage and current waveforms. (8)

b) Diode half wave rectifier supply a resistive load of  $100\Omega$  from a  $100\text{ V ac}$  r.m.s voltage source. The diode is a resistance of  $5\Omega$  during conduction state. Calculate

i) The DC output voltage

ii) DC average load current (8)

**2020/OCT/Q6** **2021/APR1/Q4** **2021/JUL2/Q4** **2021/DEC/Q4**

[Click Here to See the Answer](#)

Q5. 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  $10\text{ ohm}$  and an inductance of  $0.15\text{ H}$  is connected in series with a capacitor across a  $100\text{ V, }50\text{ Hz}$  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**

[Click Here to See the Answer](#)

Q6. A  $100\text{ KVA, }2400/240\text{ V, }50\text{ Hz, }1\text{-phase}$  transformer has no-load current of  $0.64\text{ A}$  and a core loss of  $700\text{ W}$ , 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  $40\text{ amp}$  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**

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## SECTION - III

Q7. With reference to MARPOL Annex IV



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

2019/DEC/Q9 2020/OCT/Q7 2021/JAN/Q7 2021/MAR/Q9

2021/JUL2/Q9 2021/DEC/Q7

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Q8. Explain in detail a fixed gas fire extinguisher system, indicating the required quantity of the fire - extinguishing medium, the controls required for the system installation requirement and training required to bring the system to be readily operated. (16)

2021/DEC/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)

2021/MAR/Q7 2021/APR2/Q8 2021/OCT/Q7 2021/NOV/Q7

2021/DEC/Q9

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