D. MARINE
Study Material

ELECTRO TECHNICAL OFFICER : WRITTEN

FOR INDIAN COMPETENCY EXAM

www.dmarinestudy.com

JAN-2026

1. 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)
2024/APR/01 **2025/SEP/02** **2026/JAN/01**
Click Here to See the Answer

2.Sketch and describe the method of speed control of synchronous motors by variable frequency. State the advantages of this method over the other methods of speed control. (16)
Click Here to See the Answer

3. What is soft starting of an Induction motor? Describe with a circuit using thyristors used for soft starting. Discuss its advantages and dis-advantages. (16)
Click Here to See the Answer

SECTION II

4.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 Ω, 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/04 **2024/APR/04** **2026/JAN/04**
Click Here to See the Answer

5.a) What is back emf? Derive the relation for the back emf and the supplied voltage in terms of armature resistance
b) The earth-lamps on a main switchboard comprise two 240V 60W lamps connected in the usual manner. The potential difference at the busbars is 220V. 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; and
(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 60W rating (10)
Click Here to See the Answer

6. A coil of inductance 2 H and unknown resistance is connected to a D.C. supply of 100 volts. After 4 ms the current has risen to 75% of its final steady state value. Calculate EACH of the following:
(a) the resistance by the coil;
(b) the energy stored in the coil when the current has reached its steady state value; (6)
(c) the time taken for the current to fall to 50% of its steady state value when the supply is switched off. (4)
Click Here to See the Answer

SECTION-III

7. Discuss the following with respect to International Safety Management (ISM) Code:
a) Emergency preparedness, drills & training. (6)
b) Reporting of near miss, non-conformities, accidents/incidents, and hazardous occurrences. (5)
c) Risk assessment, Identification of critical equipment, tests, and minimum spares requirement (5)
2024/APR/07
Click Here to See the Answer

8. With reference to a recent ILO notice on the health hazards from asbestos.
a) state where asbestos may be found on board ship. (6)
b) state the health risks from asbestos (5)

c) outline the precautions necessary to minimize exposure to asbestos during an emergency repair. (5)
Click Here to See the Answer

9. Petroleum vapours are dangerous substances and when mixed with air can be ignited.
a) i) sketch an explosimeter or combustion gas indicator which can be used to check the atmosphere of a tank or pumproom. (5)
ii) describe the explosimeter and its operation
iii) state one reason that may cause the explosimeter to give a false reading (5)
b) for flammable mixtures, explain the meaning of the terms lower and upper flammable limits
2024/APR/09 **2026/JAN/09**
Click Here to See the Answer

FEB-2026

SECTION-I

1.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 Test, why 3 terminals insulation testers are used in HV insulation measurement (8)
2024/AUG/02 **2026/FEB/01**
Click Here to See the Answer

2.a) Describe the circuit breaker for an a.c. generator using a sketch to show how arcing is Controlled. (8)
b) Explain the sequence of events that might occur if the breaker opens on a short circuit and state the check you would require following such event (4)

c) Give a safe procedure to follow should a main circuit breaker fail to open under fault Condition (4)
2023/MAR/01 **2024/AUG/02**
Click Here to See the Answer

3.a) Explain how the efficiency and regulation of a transformer can be assessed by open circuit and short circuit tests?
b) What is meant by equivalent resistance? (12)
Click Here to See the Answer

SECTION – II

4.a) Explain the potential hazards if liquid-cooled transformers are used.(6)
b) What are the losses in transformers? Mention the various factors which affect these losses. In a 25 KVA, 3300/233 V, single phase transformer, the iron and full-load Cu. losses are respectively 350 and 400 watts. Calculate the efficiency at half-full load, 0.8 power factor. (10)
Click Here to See the Answer

5.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)
5 b. A three phase, six pole,delta connected induction motor is supplied at 380 V, 60 Hz. It draws a current of 45 A at a power factor of 0.85 lag. The stator losses are 4 kW and the windage and friction losses total 3 kW. It runs at 19 rev/s. Calculate EACH of the following:
(a) the rotor copper loss;
(b) the shaft output power; (3)
(c) the shaft output torque. (4)
Click Here to See the Answer

6.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) Three identical coils are delta connected to a 3 ph, 440 V, 60 Hz supply and consume a total power of 9 kW at a power factor of 0.8 lag.
(a) Calculate the resistance and inductance of EACH coil. (5)
(b) If the same three coils are now connected in star to the same supply, calculate the current in each line if:
(i) one coil is short circuited;
(ii) one coil is open circuited. (5)
Click Here to See the Answer

SECTION-III

7.With reference to Annex V of **MARPOL 73/78** that deals with the prevention of pollution of the sea by garbage from ships -
a) Define the following terms:
i) Garbage
ii) Nearest land
iii) Special areas (8)
b) State the regulations governing the disposal of garbage outside special areas. (8)
2023/MAR/07 **2024/OCT/07**
Click Here to See the Answer

8. a) Explain the working principle of a **hyper mist** fire suppression system on ships. How does this system differ from traditional water-based fire suppression methods? (8)
b) Discuss the installation, maintenance, and testing requirements for a hyper mist system on board ships. How does regular upkeep ensure the system's effectiveness in an emergency? (8)
Click Here to See the Answer

9.a) Briefly describe the environmental impact of **NOx and SOx** and allowable limitations as per Annex VI of MARPOL in emission control areas and outside emission control areas. (8)

b). Briefly describe methods to control NOx emission
Click Here to See the Answer

MAR-2026

1 a) What are safety incorporated in ACB of ship's generator and prime mover? (10)
b) Explain the procedure to test reverse power relay. (6)
Click Here to See the Answer

2. a) What are the advantages and advantages of Neutral insulated system (6)
b) An Alternator does not build up any voltage after start. Describe step by step procedure to solve the problem for all reasons. (10)
Click Here to See the Answer

3. 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/01 **2022/JAN/01** **2025/NOV/02** **2026/MAR/03**
Click Here to See the Answer

SECTION II

4.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 2, 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/04 **2024/APR/04** **2026/JAN/04** **2026/MAR/04**
Click Here to See the Answer

5.a) What is back emf? Derive the relation for the back emf and the supplied voltage in terms of armature resistance (6)
b) The earth-lamps on a main switchboard comprise two 240V 60W lamps connected in the usual manner. The potential difference at the busbars is 220V.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; and (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 60W rating. (10)
2022/DEC/05 **2026/MAR/05**
Click Here to See the Answer

6. A coil of inductance 2 Hand unknown resistance is connected to a D.C. supply of 100 volts.
After 4 ms the current has risen to 75% of its final steady state value, Calculate EACH of the following:
(a)the resistance by the coil;
(b) the energy stored in the coil when the current has reached its steady state value;(6)
(c) the time taken for the current to fall to 50% of its steady state value when the supply is switched off. (4)
2026/JAN/06 **2026/MAR/06**
Click Here to See the Answer

SECTION-III

7. i) Describe CO2 fixed firefighting system for machinery spaces and cargo spaces of a bulk carrier.
"i) Explain safety precautions taken prior to release of CO2 to the engine room. (8)
2021/JAN/09 **2021/APR/08** **2021/JUL/08** **2022/FEB/08** **2026/MAR/07**

Click Here to See the Answer

8 i) Sketch and describe hydraulic circuit of steering gear incorporating automatic isolation system.
ii)Explain 'emergency steering (4)
iii)Describe the routine tests of steering gear as per SOLAS requirement. (4)
2021/APR/09 **2021/AUG/07** **2026/MAR/08**
Click Here to See the Answer

9.(a) (i) With respect to the hazardous areas of tankers, explain the term flameproof (Exd) for electrical equipment. (6)
(i) State the type of electrical equipment that would be protected in this way. (4)
(b) List likely defects of flameproof equipment. (6)
Click Here to See the Answer

APR-2026

1(a) Describe the circuit breaker for an A.C. generator using a sketch to show how arcing is Controlled. [8]
(b) Explain the sequence of events that might occur if the breaker opens on a short circuit and state the check you would require following such event; Give a safe procedure to follow should a main circuit breaker fail to open under fault Condition. [8]
2023/MAR/01 **2024/AUG/02** **2026/FEB/02** **2026/APR/01**
Click Here to See the Answer

2. In a ship's **power system,** the neutral on the low voltage side is not grounded, but it is mandatory to ground the neutral in high voltage systems. Discuss in detail for the above difference and with suitable sketches, explain the different earthing arrangements for HV system. [16]
2023/MAR/02 **2026/APR 02**
Click Here to See the Answer

3(a) In A.C. generators, voltage dip occurs in two stages.
Sketch a voltage-time graph showing the pattern of voltage dip. Referring to this graph, state with reasons the effect on the electrical system of a small power installation when a large load is suddenly switched on.
(b) Explain EACH of the following categories of voltage control:
(i) Error operated;
(ii) Functional.
2023/MAR/03 **2026 /APR/03**
Click Here to See the Answer

SECTION: II

4 (a) Why is a **synchronous motor** not self-starting? What are the various ways in which it can be started?

(b) Differentiate Ge and Si diode characteristics. The reverse bias saturation current for a P-N junction diode is 1.0 μA at 300 K. Determine its AC resistance at 150 mV forward bias, [10]
2023/MAR/Q4 **2026/APR/04**
Click Here to See the Answer

5 (a) Describe the **no-load saturation** characteristic of a D.C. generator.
5 (b) A coil of inductance 2H and unknown resistance is connected to a D.C. supply of 100 volts. After 4 ms the current has risen to 75% of its final steady state value. Calculate EACH of the following: [10]
Click Here to See the Answer

6(i) the resistance by the coil:
(ii) the energy stored in the coil when the current has reached its steady state value;
(a) What is **back emf?** Derive the relation for the back emf and the supplied voltage in terms of armature reactance.
(b) Two earth lamps at 120 V, 15 W are used on a 110 V distribution circuit. Due to damage to a motor, the resistance of the positive line is reduced to 10 ohm and that of the negative line to 5ohm. Find the voltage across each lamp and the extra load on the generator due to the fault. [10]
2023/MAR/Q6 **2026/APR/06**
Click Here to See the Answer

SECTION: III

7.With reference to **Annex V** of MARPOL 73/78 that deals with the prevention of pollution of the sea by garbage from ships-
(a) Define the following terms:
(i) Garbage.
(ii) Nearest land.
(iii) Special areas.
(b) State the regulations governing the disposal of garbage outside special areas.

2023/MAR/Q7 **2026/APR/07**
Click Here to See the Answer

8 With reference to oil monitoring of effluent from oil tanker cargo discharges:
(a) Describe with a sketch, the general arrangement of an oil discharge monitoring and control 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 **2023/MAR/Q8** **2026 /APR/08**
Click Here to See the Answer

9. Explain the principle of **port State control** and give in detail the verification the Port State Control Officer may carry out with reference to the following:
(a) Emergency generator
(b) Auxiliary steering gear
(c) Lifeboat engine
(d) Bilge pump
(e) SOPEP
Click Here to See the Answer

JUNE-2026

Q1. a) Compare the methods of obtaining speed regulation of a three-phase induction motor generally used in tankers by means of:
i. Rotor resistance ii. Cascade system iii. Pole-changing
Give examples where each system may be employed with advantage.
2023/DEC/Q1
Click Here to See the Answer

Q2. 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
(b) Ultrasonic level sensor
(c) Float
2023/DEC/Q2
Click Here to See the Answer

Q3. With reference to squirrel cage, induction, electric motors:
(a) Describe the construction of such a motor.
(b) Sketch the torque-speed curve of such a motor.
(C) Describe a method employed by a retrofitted device used to improve the part-load performance of an induction motor.
2023/DEC/Q3
Click Here to See the Answer

Q4. (a) Explain the significance of the root mean square value of an alternating current or voltage wave form; Define the form factor of such a wave form.
(b) A 72 kVA transformer supplies a heating and lighting load of 12 kW at unity power factor and a motor load of 70 kVA at 0.766 (lagging) power factor.
Calculate the minimum rating of the power factor improvement capacitors which must be connected in the circuit to ensure that the transformer does not become overloaded.
2023/DEC/Q4
Click Here to See the Answer

Q5. (a) Show how the power that is transferred across the air gap of the three-phase induction motor is represented. Explain the terms. what portion of this power is useful power?
(b) A 440 V shunt motor takes an armature current of 30 A at 700 rev/min. The armature resistance is 0.7 Ω. If the flux is suddenly reduced by 20 percent, to what value will the armature current will rise momentarily?

Assuming unchanged resisting torque to motion, what will be the new steady value of speed and armature current? Sketch graphs showing armature current and speed as function of time during the transition from initial to final, steady-state conditions.

2023/DEC/Q5

Click Here to See the Answer

Q6. (a) What are the factors that determine the synchronous speed of a motor?

(b) A three-phase induction motor is wound for four poles and is supplied from a 50 Hz system. Calculate:

(i)The synchronous speed.

(ii)The speed of the rotor when the slip is 4 percent.

(iii)The rotor frequency when the speed of the rotor is 600 r/min.

2023/DEC/Q6

Click Here to See the Answer

Q7. With reference to the Maritime Labour Convention (MLC) 2006, discuss the requirements for seafarers regarding:

(a) Minimum age to work onboard vessels.

(b) Seafarers Employment Agreements.

(c) Hours of work and hours of rest.

2023/DEC/Q7

Click Here to See the Answer

Q8. With reference to entry into enclosed spaces onboard:

(a) Define an “Enclosed space” and give examples of enclosed spaces onboard.

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

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

2023/DEC/Q8

Click Here to See the Answer

Q9. With reference to the free fall lifeboat of an ocean-going ship, explain:
(a) Periodical maintenance, tests, and checks on the lifeboat and releasing gear.
(b) Secondary means of lowering.
(c) Lifeboat drills.
2023/DEC/Q9
Click Here to See the Answer

JULY-2026

Q1. (a) State essential electrical services on board that are able to be operable under fire conditions.
(b) Explain how electric cables for the essential services in part (a) pass through bulkheads whilst maintaining gastight and watertight integrity.
(c) State the requirements for the cables which supply electrically driven emergency fire pumps.
Click Here to See the Answer

Q2. (a) Sketch a circuit diagram of a push-button direct-on-line (DOL) contactor starter for a three-phase motor incorporating overload and short-circuit protection. [8]
(b) Indicate, on a sketch, the typical characteristic curves of current and torque against speed. State the disadvantages of a direct-on-line start squirrel cage induction motor.
Click Here to See the Answer

Q3. Differentiate between half-wave and full-wave rectification. State where half-wave rectification may be used and the purpose for which it is not well adapted. Sketch a bridge connection by which full-wave rectification may be obtained.
Click Here to See the Answer

Q4.(a) What design factor limits the maximum torque of a d.c. motor?
(b) A shunt motor runs on no load at 700 r/min off a 440 V supply. The resistance of the shunt circuit is 240 Ω. The following table gives the relationship between the flux and the shunt current:

Shunt Current (A)	**0.5**	**0.75**	**1.0**	**1.25**	**1.75**	**2.0**
Flux per Pole (mWb)	6	8	9.4	10.2	11.2	11.5

Calculate the additional resistance required in the shunt circuit to raise the no-load speed to 1000 rpm.
Click Here to See the Answer

Q5. (a) On what factors does the capacitance of a parallel-plate capacitor depend?
(b) A tuned circuit consisting of a coil having an inductance of 200 μH and a resistance of 20 Ω in parallel with a variable capacitor is connected in series with a resistor of 8000 Ω across a 60 V supply having a frequency of 1 MHz. Calculate:
(a) The value of C to give resonance.
(b) The dynamic impedance and the Q factor of the tuned circuit.
(c) The current in each branch.
Click Here to See the Answer

Q6.(a) The capacitor-start induction-run motor has a much higher starting torque than the resistance split-phase motor. Explain.
(b) An eight-pole armature is wound with 480 conductors. The magnetic flux and the speed are such that the average e.m.f. generated in each conductor is 2.2 V, and each conductor is capable of carrying a full-load current of 100 A. Calculate the terminal voltage on no load, the output current on full load and the total power generated on full load when the armature is:
(i) lap connected.
(ii) wave connected.
Click Here to See the Answer

Q7. Explain the cargo hold fire detection system used on ships. Discuss the maintenance procedures for this system and outline the steps taken when a fire is detected in the cargo hold.
Click Here to See the Answer

Q8.(a) The ISM Code requires the company to establish procedures for preparing for and responding to potential emergency shipboard situations. How does the SMS ensure that these emergency procedures are continually evaluated for effectiveness?
(b) How does the ISM Code dictate the procedure for reporting accidents and hazardous occurrences? What is the objective of reporting a "near miss" if no damage or injury occurred?
Click Here to See the Answer

Q9. Briefly discuss the following with respect to safety of navigation:
(a) Bridge Navigation Watchkeeping Alarm System (BNWAS)
(b) Long Range Identification and Tracking of Ships (LRIT)
(c) Voyage / Simplified Voyage Recorder (VDR/S-VDR)
Click Here to See the Answer