D. MARINE
Study Material

ELECTRO TECHNICAL OFFICER : WRITTEN

FOR INDIAN COMPETENCY EXAM

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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**
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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)
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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)
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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**
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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)
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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)
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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
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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)
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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**
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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)
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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**
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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)
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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)
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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)
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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)
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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**
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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)
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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

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