D. MARINE
Study Material

MEO CLASS 2 WRITTEN: MET

(MARINE ELECTRO TECNOLOGY)

FOR INDIAN COMPETENCY EXAM

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JANUARY – 2026
SECTION-I

Q1. (a) List the various losses which occur in a squirrel cage induction motor on load.
(b) State which of these losses is:
(i) Independent of load current and speed;
(ii) Dependent on load current.
(iii) Dependent on speed.
2026/JAN/Q1
Click Here to See the Answer

Q2. In the event of a failure, of the main electrical power supply on a ship, an emergency source of power must be available, state the circuits which must be fed from such a source and discuss the reasons governing the selection of such circuits.
2023/SEP/Q2 **2026/JAN/Q2**
Click Here to See the Answer

Q3. (a) Draw a circuit diagram illustrating how a single thyristor (Silicon controlled rectifier) may be used to provide a variable voltage D.C. output from a single phase A.C. supply.
(b) Explain how the firing angle of the thyristor is varied.
(c) Sketch waveforms for the output voltage when the firing angle is:
(i) 60°
(ii) 120°. (16)
2026/JAN/Q3
Click Here to See the Answer

Q4. With reference to a 3 speed A.C. cage motor driven cargo winch:
A. Sketch a circuit diagram for a pole change motor. (8)
B. Describe how speed changes and braking are achieved. (8)

2022/OCT/Q4 **2024/JUL/Q5** **2024/AUL/Q4** **2025/JAN/04** **2025/OCT/Q4**

Q5. With reference to the condition monitoring of electrical machinery:
A. State TWO important parameters that may be recorded. (8)
B. Explain how the parameters are measured and what defects may be revealed. (8)
2022/OCT/Q5 **2023/SEP/05** **2025/OCT/Q5**
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SECTION-II

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 wave form. (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,
2023/JUNE/Q6 **2024/UL/Q6** **2024/NOV/Q5** **2025/APR/Q4** **2025/OCT/Q6**
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Q7. A. By means of a schematic circuit diagram illustrate the peak rectifier. If the supply voltage is v(t) = VSinωt, what is the voltage across the load resistor? (6)
B. A series circuit comprising a 500 resistor, a coil having resistance and inductance and a capacitor is connected across a 50 V variable frequency supply. When the frequency is 400 Hz the current reaches its maximum value of 0.6 A and the voltage across the capacitor is 200 V. Calculate EACH of the following:
(a) The value of the capacitance.
(b) The resistance and inductance of the coil.
(c) The power taken from the supply.
(d) The circuit power factor. (10)
2026/JAN/Q7
Click Here to See the Answer

Q8. A. Why is it important to maintain high efficiency of operation and low values of voltage regulation for power transformers? (6)
B. A 100 KVA transformer has 400 turns on the primary and 80 turns on the secondary. The primary and secondary resistances are 0.3 1 and 0.01 respectively and the corresponding leakage reactance's are 1.1 2 and 0.035 2 respectively. The supply voltage is 2200 V. Calculate:
(i) The equivalent impedance referred to the primary circuit.
(ii) The voltage regulation and secondary terminal voltage for full load having a power factor of (a) 0.8 lagging and (b) 0.8 leading. (10)
2024/JUN/Q7 **2024/AUG/Q7** **2024/NOV/Q8**
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Q9. 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)
B. A 3 ph 440 V, 60 Hz, 8 pole induction motor runs at a power factor of 0.85 lag and drives a load of 8 kW at a speed of 14.4 rev/s. The stator loss is 1 kW and the rotation losses (windage and friction) amount to 0.8 kW. Calculate EACH of the following:
(a) The synchronous speed.
(b) The rotor Copper loss
(C) The input power to the motor
(d) The motor current.
2026/JAN/Q9
Click Here to See the Answer

Q10. 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 batteries A, B and C have their negative terminals connected together, between the positive terminals of A and B there is a resistor of 0.5 ohm and between B and C there is a resistor of 0.3 ohm. Specifications of the three batteries are given below:
Battery A 105 V, Internal resistance 0.25 ohm

Battery B 100 V, Internal resistance 0.2 ohm
Battery C 95 V, Internal resistance 0.25 ohm
Determine the current values in the two resistors and the power dissipated by them. (10)
2024/NOV/Q10 **2025/OCT/Q10** **2023/JUN/Q10** **2024/JUN/Q9** **2024/AUG/Q9** **2024/NOV/Q.10** **2025/OCT/Q10**
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FEB-2026

SECTION – I

Q1. A) Describe the circuit breaker for an A.C. generator using a sketch to show how arcing is controlled. (6)
(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. (5)
(C) Give a safe procedure to follow should a main circuit breaker fail to open under fault Condition. (5)
2021/APR/Q3 **2022/DEC/Q1** **2024/DEC/Q5** **2025/FEB/Q1** **2025/JUL/Q1** **2026/FEB/Q1**
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Q2. A. With respect to measuring instruments what is the difference between analogue and digital
measuring instruments. Explain the working principle of each type. (6)
B. Describe with the aid of simple sketches one analogue and one digital measuring instrument you
have used onboard. (10)
2022/DEC/Q2 **2025/FEB/Q2** **2025/JUL/Q2** **2026/FEB/Q2**
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Q3. With respect to power transformers kindly explain the following protections (16)
a. Overload protection

b. Overcurrent protection for phase faults
c. Earth Fault protection
d. Differential protection
e. Directional protection
Click Here to See the Answer

- -SIMILAR ANSWER - -

Q3. With respect to power transformers kindly explain the following protections (16)
a. Overload protection
b. Overcurrent protection for phase faults
c. Earth Fault protection
d. Differential protection
2026/FEB/Q3
Click Here to See the Answer

Q4. In A.C. generators, voltage dip occurs in two stages.
a) I. Sketch a voltage-time graph showing the pattern of voltage dip. (4)
II. 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 (4)
b) Explain EACH of the following categories of voltage control:
(i) Error operated. (4)
(ii) Functional. (4)
2022/DEC/Q4 **2025/FEB/Q4** **2025/JUL/Q4** **2026/FEB/Q4**
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Q5. In some circumstances electrical current may be induced into the shafting of rotating machinery.
a) State the problem that may be caused by this current. (6)
b) Explain with aid of sketches, how currents may be avoided or reduced in the following instances:
(i) D.C machines
(ii) Main shafting fitted with a bronze propeller (10)
2022/DEC/Q5 **2025/FEB/Q5** **2025/JUL/Q5** **2026/FEB/Q5**

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SECTION – II

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 wave form. (6)
B. Draw the circuit of Half-wave rectifier and its output waveform. A diode whose internal resistance is 20Ω is to supply power to 1000 Ω load from 110 V (RMS) source. Calculate
(i) peak load current,
(ii) DC load current,
(iii) AC load current. (10)
2022/DEC/Q6 **2025/FEB/Q6** **2025/JUL/Q6** **2026/FEB/Q6**
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Q7. a. By means of a schematic circuit diagram illustrate the peak rectifier. If the supply voltage is v(t) = Vra Sin wt, what is the voltage across the load resistor? (6)
b. A D.C. motor takes an armature current of 110 A at 480 V. The resistance of the armature circuit is 0.2Ω. The machine has six poles and the armature is lap-connected with 864 conductors. The flux per pole is 0.05 Wb. Calculate:
(i) The speed.
(ii) The gross torque developed by the armature. (10)
2022/DEC/Q7 **2025/FEB/Q7** **2025/JUL/Q7** **2026/FEB/Q7**
Click Here to See the Answer

Q8. 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)
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 per cent.
iii. The rotor frequency when the speed of the rotor is 600 r.p.m. (10)

2022/DEC/Q8 **2025/FEB/Q8** **2025/JUL/Q8** **2026/FEB/Q8**
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Q9. A. What is leakage flux as it applies to the iron-core transformer? How is it considered in the analysis of the transformer? (6)
B. Three conductors fitted side by side in the stator of a salient-pole alternator. Each generates a maximum voltage of 200V (sinusoidal). The angle subtended at the centre of the stator between adjacent conductors are 20 electrical degrees. If the three conductors are connected in series, find
(i) the r.m.s. value of the effective voltage and
(ii) the 'breadth factor'. Using the theory that is the basis of this problem, give one reason why three-phase current has been introduced. (10)
2022/DEC/Q9 **2025/FEB/Q9** **2025/JUL/Q9** **2026/FEB/Q9**
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Q10. A. What are the factors which determine the synchronous speed of a motor? (6)
B. A twelve-pole, three-phase, delta-connected alternator runs at 600 rev/min and supplies a balanced star-connected load. Each phase of the load is a coil of resistance 35 ohm and inductive reactance 25 ohm. The line terminal voltage of the alternator is 440V. Determine
(a) frequency of supply
(b) current in each coil
(c) current in each phase of the alternator
(d) total power supplied to the load. (10)
2022/DEC/Q10 **2025/FEB/Q10** **2025/JUL/Q10** **2026/FEB/Q10**
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MAR-2026

SECTION – I

Q1. With reference to a three-phase shipboard electrical distribution system: (16)
a) Enumerate the advantages of an insulated neutral system.
b) Enumerate the disadvantages of an insulated neutral system.
c) Describe how the earthed neutral system is Earthed.
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.
2024/FEB/Q4 **2024/MAR/Q5** **2024/DEC/Q1** **2025/SEP/Q4** **2026/MAR/Q1**
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Q2. A. Explain the meaning of the term power factor correction. (16)
B. State TWO advantages of power factor correction.
C. Explain, with the aid of a circuit diagram, how power factor correction can be affected in a three-phase circuit using capacitors.
D. Explain one method other than the use of capacitors by means of which power factor correction may be affected.
2022/NOV/Q5 **2025/AUG/Q1** **2025/NOV/Q1** **2026/MAR/Q2**
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Q3. List at least two 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/DEC/Q3 **2026/MAR/Q3**
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Q4. a) Explain what is meant by the term single phasing. (5)
b) Explain the probable effect of single phasing on a delta connected squirrel cage induction motor on 75% full load. (5)
c) State a method by which a motor can be protected against the effects of single phasing. (6)
2026/MAR/Q4
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Q5. A) Describe the circuit breaker for an A.C. generator using a sketch to show how arcing is controlled. (6)
(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.
(C) Give a safe procedure to follow should a main circuit breaker fail to open under fault Condition. (5)
2021/APR/Q3 **2022/DEC/Q1** **2024/DEC/Q5** **2025/FEB/Q1** **2025/JUL/Q1** **2026/FEB/Q1** **2026/MAR/Q5**
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Q6. 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 a 110 V sinusoidal A.C. supply. The circuit has a resistance of 50 □□ to current in one direction and, due to the rectifier, an infinite resistance to current in the reverse direction. Calculate:
(i) The readings on the ammeters.
(ii) The form and peak factors of the current wave. (10)
2024/JUN/Q6 **2024/AUG/Q6** **2024/DEC/Q6** **2026/MAR/Q6**
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Q7. 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; secondary 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, 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)
2024/DEC/Q7 **2026/MAR/Q7**
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Q8. A. What is Silicon controlled rectifier (SCR)? How is the breakover voltage of the SCR defined? (6)
B. A D.C. motor takes an armature current of 110 A at 480 V. The resistance of the armature circuit is 0.2Ω. The machine has six poles and the armature is lap-connected with 864 conductors. The flux per pole is 0.05 Wb. Calculate:
(a) The speed;
(b) The gross torque developed by the armature. (10)
2024/DEC/Q8 **2026/MAR/Q8**
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Q9. A. List the factors that determine the maximum developed torque of the induction motor. (6)
B. The primary and secondary windings of a 500 KVA transformer have resistance of 0.42 Ω and 0.0019 Ω respectively. The primary and secondary voltages are 11000 V and 415 V respectively and the core loss is 2.9 kW, assuming the power factor of the load to be 0.8. Calculate the efficiency on
(i) Full load
(ii) Half load. (10)
2024/DEC/Q9 **2026/MAR/Q9**
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Q10. A balanced start connected three phase load has a coil of inductance 0.2 H and resistance 50 Ω in each phase. It is supplied at 415 V, 50 HZ. Calculate EACH of the following. (16)

a) the line current.
b) the power factor
c) the value of each of three identical delta connected capacitors to be connected across the same supply to raise the power factor to 0.9 lag.
d) the new value of the current.

2026/MAR/Q10

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APR- 2026

Q1. Differentiate between squirrel cage and wound rotor motor of the three phases: A.C. induction. In respect of the following: (16)
A. Rotor construction,
B. Torque characteristic,
C. Speed variation.

2020/OCT/Q1 **2022/MAR/Q3** **2023/JULY/Q1** **2023/DEC/Q1** **2024/APR/Q1**

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Q2. With reference to an emergency source of electrical power in cargo ships: (16)
A. Describe a typical power source.
B. Give a typical list of essential services, which must be supplied simultaneously.
C. Explain how the emergency installation can be periodically tested.

2020/FEB/Q4 **2020/OCT/Q5** **2023/JULY/Q2** **2023/OCT/Q4** **2023/DEC/Q2** **2024/APR/Q2** **2026/APR/Q2**

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Q3. The direct online start of squirrel cage motor is used for most electrical drives on A.C. powered ships. Describe with sketches as necessary one method of overcoming each of the following Problems:
A. High starting current. (8)
B. Low starting torque. (8)

2021/APR/Q3(M) **2023/JULY/Q3** **2023/OCT/Q5** **2023/DEC/Q3** **2024/APR/Q3** **2026/APR/Q3**

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Q4. a) (i) Discuss the various hazards and problems which are associated with electric cable insulation in the event of fire.
(ii) Suggest remedies for these problems. (8)
b) State how the spread of fire may be reduced by the method used for installing electric cables. (8)

2020/NOV/Q4 **2023/JULY/Q4** **2023/DEC/Q4** **2024/APR/Q4** **2026/APR/Q4**

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Q5. 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? (3)
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)
e) What is the condition to be satisfied for achieving maximum running torque in an induction motor? (3)

2021/MAR/Q4 **2022/JUN/Q5** **2023/JULY/Q5** **2023/DEC/Q5** **2024/APR/Q5** **2026/APR/Q5**

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SECTION – II

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 wave form. (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/JAN/Q8 **2021/FEB/Q8** **2021/MAR/Q10** **2021/APR/Q6** **2021/SEP/Q6** **2021/OCT/Q9** **2021/NOV/Q6** **2022/FEB/Q8** **2022/MAR/Q9** **2022/JUN/Q6** **2023/APR/Q6** **2023/JUNE/Q6** **2024/JUL/Q6** **2024/NOV/Q6** **2025/APR/Q4** **2025/OCT/Q6** **2026/JAN/Q6** **2026/APR/Q6**

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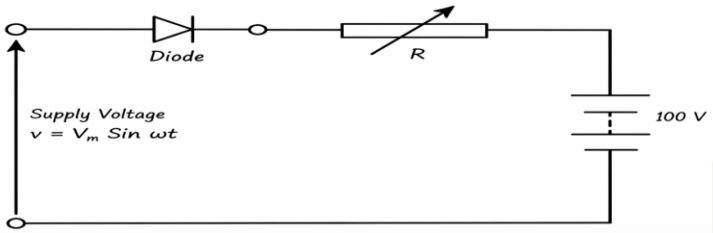
Q7. A. By means of a schematic circuit diagram illustrate the peak rectifier. If the supply voltage is v(t) = V□Sinωt, what is the voltage across the load resistor? (6)

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/MAR/Q8 **2021/JUL/Q8** **2021/SEP/Q9** **2022/JUN/Q7** **2022/OCT/Q7** **2023/JAN/Q7** **2023/MAR/Q7** **2023/JUNE/Q7** **2024/NOV/Q7** **2025/OCT/Q7** **2026/APR/Q7**

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Q8. A. Why is it important to maintain high efficiency of operation and low values of voltage regulation for power transformers? (6)

B. A 100 KVA transformer has 400 turns on the primary and 80 turns on the secondary. The primary and secondary resistances are 0.3 Ω and 0.01 Ω respectively and the corresponding leakage reactances are 1.1 Ω and 0.035 Ω respectively. The supply voltage is 2200 V. Calculate:

(i) The equivalent impedance referred to the primary circuit.

(ii) The voltage regulation and secondary terminal voltage for full load having a power factor of (a) 0.8 lagging and (b) 0.8 leading. (10)

2023/JUNE/Q8 **2025/OCT/Q8** **2023/MAR/Q8** **2024/NOV/Q8**
2024/JUN/Q7 **2026/JAN/Q8**
2024/AUG/Q7 **2023/JAN/Q8** **2026/APR/Q8**
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Q9. 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)
B. The low-voltage release of an A.C. motor-starter consists of a solenoid into which an iron plunger is drawn against a spring. The resistance of the solenoid is 35 ohms. When connected to a 220 V, 50 Hz, A.C. supply the current taken is at first 2 A, and when the plunger is drawn into the "full-in" position the current falls to 0.7 A. Calculate the inductance of the solenoid for both positions of the plunger and the maximum value of flux-linkages in weber-turns for the "full-in" position of the plunger. (10)
2020/NOV/Q9 **2023/JAN/Q9** **2023/JUNE/Q9** **2023/OCT/Q9**
2024/JUN/Q8 **2024/AUG/Q8** **2024/NOV/Q9** **2025/OCT/Q9**
2026/APR/Q9
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Q10. 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 batteries A, B and C have their negative terminals connected together, between the positive terminals of A and B there is a resistor of 0.5 ohm and between B and C there is a resistor of 0.3 ohm. Specifications of the three batteries are given below:
Battery A 105 V, Internal resistance 0.25 ohm
Battery B 100 V, Internal resistance 0.2 ohm
Battery C 95 V, Internal resistance 0.25 ohm
Determine the current values in the two resistors and the power dissipated by them. (10)

2023/JAN/Q10 **2023/JUNE/Q1** **2023/OCT/Q10**
2024/JUN/Q9 **2024/AUG/Q9** **2024/NOV/Q10** **2025/OCT/Q10**
2026/APR/Q10

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