D. MARINE
Study Material

MEO CLASS 4 WRITTEN: MET

(MARINE ELECTRO TECNOLOGY)

FOR INDIAN COMPETENCY EXAM

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JANUARY – 2025

Q1. (a) Explain the term single phasing as applied to poly phase induction motors. (4)
(b) State the likely causes of single phasing and the consequences if motors are not adequately protected. (4)
(c) Describe with the aid of sketches THREE methods for motor protection should single phasing occur. (8)
2022/OCT/Q1 **2023/JUL/Q1** **2024/APR1/Q1** **2025/JAN1/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) State why an Earthed neutral system may be earthed through a resistor
(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)
2024/APR1/Q2 **2025/JAN1/Q2**
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Q3. (a) Describe the principle of operation of EACH of the following detecting elements: (8) (i) Bi-metal strips (ii) Thermistors
(b) Explain, with the aid of sketches, typical applications where the devices described in (a) may be employed in high voltage electrical systems. (8)
2024/APR1/Q3 **2025/JAN1/Q3**
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Q4. (a) Sketch the following types of electric motor connections: (8) (i) A star connection (ii) A delta connection (b) Explain how and why star and delta connections are combined to produce a Star / Delta starter for an electric motor. (8)
2024/APR1/Q4 **2025/JAN1/Q4**

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Q5. (a) State the necessary conditions required prior to the synchronizing of electrical alternators. (6)
(b) Describe the type of cumulative damage that may be caused when alternators are incorrectly Synchronized. (6)
(c) Explain how the damage referred to in (b) can be avoided/reduced. (4)
2024/APR1/Q5 **2025/JAN1/Q5**
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Q6. (a) Explain the principle of conservation of charge and its relationship to Kirchoff's current law. (6)
(b) The open-circuit voltage of a cell as measured by a voltmeter of 100 ohm resistance, was 1.5 V, and the p.d. when supplying current to a 10 ohm resistance was 1.25 V, measured by the same voltmeter. Determine the e.m.f. and internal resistance of the cell. (10)
2024/APR1/Q6 **2025/JAN1/Q6**
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Q7. The loads of a 4-wire, 3-phase systems are: Red line to neutral current = 50 A, power factor of 0.707 (lagging) Yellow line to neutral current = 40 A, power factor of 0.866 (lagging) Blue line to neutral current = 40 A, power factor 0.707 (leading). Determine the value of the current in the neutral wire. (16)
2024/APR1/Q7 **2025/JAN1/Q7**
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Q8. (a) Describe the effect of running an induction motor on reduced voltage. (b) A motor takes a current of 60 amperes at 230 volts, the power input being 12 kW. Calculate the power component and the reactive component of the input current. (10)
2024/APR1/Q8 **2025/JAN1/Q8**
Click Here to See the Answer

Q9. (a) Describe the basic principles of self-excited generators (6)

(b) The armature resistance of a 200 V-shunt motor is 0.4 Ohms. The no load (this is the term used when the motor is running light, i.e. not loaded) armature current is 2A. When loaded and taking an armature current of 50A, the motor speed is 1200 rev/min. Find the approximate no load speed **2024/MAY2/Q6** **2024/AUG/Q6** **2025/JAN1/Q9**

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FEBRUARY – 2025

Q1. Explain with a simple line sketch, a main engine jacket cooling automatic control system capable of maintaining the jacket water temperature within close limits during wide changes in engine load. (16)
2024/JAN/Q1 **2024/JUN/Q1** **2024/NOV/Q1** **2025/FEB/Q1**
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Q2. a) What is the function of insulation in an electric conductor? (3) b) What are the various classes of insulation? (8) c) What are the desired properties of insulating materials? (5)
2024/JAN/Q2 **2024/JUN/Q2** **2024/NOV/Q2** **2025/FEB/Q2**
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Q3. a) How protection is provided for electrical short circuit. (4) b) Describe the construction and operation of HRC fuses. (8) c) What are the advantages of HRC fuses. (4)
2024/JAN/Q3 **2024/JUN/Q3** **2024/NOV/Q3** **2025/FEB/Q3**
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Q4. a) Shunt generators having drooping characteristics are best suited for parallel operation. Discuss. (6)
b) Two 220 V D.C. generators each having linear external characteristics, operated in parallel. One machine has a terminal voltage of 270 V on on-load and 220V at a load current of 35 A, while the other has a voltage of 280 V at no-load and 220 V 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. (10)
2024/JAN/Q4 **2024/MAR/Q9** **2024/JUN/Q4** **2024/SEP1/Q4** **2024/NOV/Q4** **2025/FEB/Q4**
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Q5.a) Briefly explain static induction and dynamic induction. (6)

b) A coil of 250 turns is wound uniformly over a wooden ring of mean circumference 500mm and uniform cross-sectional area of 400mm2 . If the current passed through the coil is 4A find (a) the magnetizing force (b) the total flux. (10)

2024/JAN/Q5 **2024/JUN/Q5** **2024/NOV/Q5** **2025/FEB/Q5**

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Q6. (a) Explain how excitation of the rotor is produced and supplied. (6)
(b) A 25 kVA, single phase transformer has 250 turns on the primary and 40 turns on the secondary winding. The primary is connected to 1500 V, 50 Hz mains calculate: (10) (i) Secondary emf (ii) Primary and secondary current on full load (iii) Maximum flux in the core.

2025/FEB/Q6

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Q7. a) State the conditions which must be satisfied before an A.C generator can be paralleled with live bus-bars. (4)
b) Sketch a lamp-bright configuration for synchronizing lamps. (8)
c) State the advantages and disadvantages of the lamps-bright system over lamps-darks system. (4)

2022/AUG/Q4 **2023/JAN/Q5** **2023/MAR/Q4** **2024/JAN/Q7** **2024/SEP2/Q2** **2024/NOV/Q7** **2025/FEB/Q7**

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2023/JUL/Q5 **2024/JAN/Q8** **2024/NOV/Q8** **2025/FEB/Q8**

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Q9. a) Differentiate between resistance, induction and impedance in an a.c. circuit. (6)

b) A circuit is made up from resistors of value 2Ω, 4Ω, 5Ω and 10Ω connected in parallel. If the current is 8.6A, find the voltage drop across the arrangement and the current in each resistor. (10)

2024/JAN/Q9 **2024/NOV/Q9** **2025/FEB/Q9**

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MARCH – 2025

Q1. (a) How busbar inspection and maintenance is carried out. (10)
(b) What are safety precautions taken while doing maintenance on the busbar?
2023/FEB/Q5 **2024/DEC1/Q1** **2025/MAR/Q1**
Click Here to See the Answer

Q2. Draw and explain the shape of the characteristic curve of a p-n junction diode in forward and reverse bias modes (16)
2022/AUG/Q2 **2022/SEP/Q2** **2023/MAR/Q2** **2024/DEC1/Q2** **2025/MAR/Q2**
Click Here to See the Answer

Q3. a) Explain the working of a Megger with the aid of its internal circuit.
b) What safety measures are taken while using a Megger? (4)
2023/MAY1/Q2 **2023/SEP/Q3** **2024/DEC1/Q3** **2025/MAR/Q3**
Click Here to See the Answer

Q4. a) What is the purpose of preferential Tripping system on ship's electrical network? (6) b) Explain the various stages of preferential trips including the loads connected to those stages. **2023/MAY1/Q3** **2024/DEC1/Q4** **2025/MAR/Q4**
Click Here to See the Answer

Q5. a) The current transformer (CT) and potential transformer (PT) or voltage transformer are both measuring devices. List their shipboard application. (6)
b) Sketch and describe any one type of current transformer. (10)
a) List the applications of CT and PT (Current and voltage Transformers). (6) b) Sketch and describe any one type of current Transformer. (10)
2023/MAY1/Q4 **2024/DEC1/Q5** **2025/MAR/Q5**
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Q6. a) What are the safety devices provided on the steering gear system?
b) What is the significance of the shaft hull earthing device on the shafting?
2024/DEC1/Q6 **2025/MAR/Q6**
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Q7. a) Explain Fleming's Right hand rule. (6)
b) A one-turn armature coil has an axial length of 0.4m and a diameter of 0.2m. It is rotated at a speed 500 rev/min in a field of uniform flux density of 1.2 T. Calculate the magnitude of the e.m.f. induced in the coil. (10)
2023/JUN/Q9 **2024/DEC1/Q7** **2025/MAR/Q7**
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Q8. a) Describe in detail the method used to measure the capacitance of a capacitor.(6) b) A circuit has a resistance of 3R and an inductance of 0.01 H. The voltage across its ends is 60V and the frequency is 50Hz. Calculate (i) the impedance. (ii) the power factor (iii) the power absorbed.(10)
2023/JUN/Q8 **2024/DEC1/Q8** **2025/MAR/Q8**
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Q9. a) What is the difference between a DC Generator and a DC motor? (6)
b) A 4-pole, 32 conductor, Lap-wound DC shunt generator with terminal voltage of 200 V delivering 12 A to the load has ra = 2 and field circuit resistance of 200 Ω. It is driven at 1000 RPM . i) Calculate the flux per pole in the machine. ii) If the machine has to be run as a motor with the same terminal voltage and drawing 5 A from mains, maintaining the same magnetic field, find the speed of the machine. (10)
2023/JUN/Q7 **2024/DEC1/Q9** **2025/MAR/Q9**
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APRIL – 2025 (PART-1)

Q1. With reference to the protection of electric motors explain EACH of the following: (a) Fuse back up protection (6)
(b) How a motor fitted with fuse back up protection may exceed its rated temperature without being tripped by the primary protection (6)
(c) The value of current rating at which the over current relay should be set
2024/APR2/Q1 2024/SEP2/Q1 2025/APR1/Q1
Click Here to See the Answer

Q2. a) State the conditions which must be satisfied before an A.C generator can be paralleled with live bus-bars. (4)
b) Sketch a lamp-bright configuration for synchronizing lamps. (8) c) State the advantages and disadvantages of the lamps-bright system over lamps-darks system. (4)
2023/MAR/Q4 2024/JAN/Q7 2024/JUN/Q7 2024/SEP2/Q2 2024/NOV/Q7 2025/FEB/Q7 2025/APR1/Q2
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Q3. (a) Sketch, the circuit diagram of an instrument used for measuring electrical insulation resistance. (8) (b) Describe the circuit diagram sketched in
(a), explaining how it operates when measuring electrical insulation resistance. (8)
2024/APR2/Q3 2024/SEP2/Q3 2025/APR1/Q3
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Q4. (a) Explain the working principle of an alkaline battery (8)
(b) Compare the alkaline battery with Lead-Acid battery (8)
2023/NOV/Q1 2024/APR2/Q4 2024/SEP2/Q4 2025/APR1/Q4
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Q5. (a) What is the purpose of AVR in an alternator? (6) (b) With the aid of a simple circuit diagram explain the basic working of a brushless alternator.
2023/NOV/Q4 2024/APR2/Q5 2024/SEP2/Q5 2025/APR1/Q5

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Q6. In the following circuit E1 = 13V, E2 = 19.5V, R1 = 5Ω, R2 = 7Ω, R3 = 9Ω: Find the current flowing through each resistor (16)
2023/NOV/Q7 **2024/APR2/Q6** **2024/SEP2/Q6** **2025/APR1/Q6**

Q7. A 24V emergency battery is to be charged from the 11OV ship's mains when the e.m.f. per cell has fallen to a minimum value of 1.8V. The battery consists of 12 cells in series, has a capacity of 100 Ahr at a 10 hr rate and the internal resistance is 0.03Ω/cell. If charging continues until the voltage per cell rises to 2.2V, find the value of the variable resistor needed to control the charging. The charging current can be assumed to be equal to the maximum allowable discharge current.
2024/SEP2/Q7 **2025/APR1/Q7**
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Q8. A wooden ring having a mean diameter of 200 mm and a cross-sectional area of 400mm2 is wound uniformly with a coil of 300 turns. If the current passed through the coil is 5A calculate the value of flux produced in the coil. (16)
2023/NOV/Q9 **2024/APR2/Q8** **2024/SEP2/Q8** **2025/APR1/Q8**
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Q9. A coil of resistance 10Ω and inductance 0.1H is connected in series with a capacitor of capacitance 150pF, across a 200V, 50Hz supply. Calculate:
(a) The inductive reactance (3)
(b) The capacitive reactance (3)
(c) The circuit impedance (2)
(d) The circuit current (2)
(e) The circuit power factor (2)
(f) The voltage drop across the coil (2)
(g) The voltage drop across the capacitor (2)
2023/NOV/Q6 **2024/APR2/Q9** **2024/SEP2/Q9** **2025/APR1/Q9**
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APRIL -2025(PART-2)

Q1. (a) Sketch a diesel electric propulsion arrangement for a ship (8)
(b) Describe the operation of the propulsion arrangement sketched in (a), including in your description how reversal of the propulsion motor is achieved (8)
2024/MAY2/Q1 **2024/AUG/Q1** **2025/APR2/Q1**
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Q2. Differentiate between squirrel cage and wound rotor motors, of the three phase a.c. induction type, in respect of the following: (16) (a) Rotor construction (b) Torque characteristics (c) Speed variation
2024/MAY2/Q2 **2024/AUG/Q2** **2025/APR2/Q2**
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Q3. (a) Explain open loop control system and closed loop control system with suitable examples (8)
(b) What are the merits and demerits of the two systems? (8)
2024/MAY2/Q3 **2024/AUG/Q3** **2025/APR2/Q3**
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Q4. (a) Explain why it is necessary to have reverse power protection for alternators intended for parallel operation (6)
(b) (i) Sketch a reverse power trip (5) (ii) Explain briefly the principle on which the operation of this power trip is based and how tripping is activated (5)
2022/DEC/Q2 **2024/MAY2/Q4** **2024/AUG/Q4** **2025/APR2/Q4**
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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/DEC/Q4 **2024/MAY2/Q5** **2024/AUG/Q5** **2025/APR2/Q5**
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Q6. (a) Describe the basic principles of self-excited generators (6)
(b) The armature resistance of a 200 V-shunt motor is 0.4 Ohms. The no load (this is the term used when the motor is running light, i.e. not loaded) armature current is 2A. When loaded and taking an armature current of 50A, the motor speed is 1200 rev/min. Find the approximate no load speed
2022/AUG/Q7 **2024/APR1/Q9** **2024/MAY2/Q6** **2024/AUG/Q6** **2025/JAN1/Q9** **2025/APR2/Q6**
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Q7. A 4 pole, lap wound shunt generator delivers 200 A at terminal voltage of 250 V. It has a field and armature resistance of 50 Ω and 0.05 Ω respectively. Determine: (16)
(a) Armature current (b) Generated e.m.f (c) Current per armature parallel paths (d) Power developed
2024/MAY2/Q7 **2024/AUG/Q7** **2025/APR2/Q7**
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Q8. (a) State the relationship between impedance, voltage and current (6)
(b) The filament of a 230V lamp takes a current of 0.261A when working at its normal temperature of 2000° C. The temperature coefficient of the tungsten filament material can be taken as 0.005 /ºC at 0°C. Find the approximate current which flows at the instant of switching on the supply to the cold lamp, which can be considered to be at a room temperature of 20° C (10)
2022/AUG/Q9 **2022/NOV/Q9** **2024/MAY2/Q8** **2024/AUG/Q8** **2025/APR2/Q8**
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Q9. (a) Describe the effect of running an induction motor on reduced voltage (6)
(b) A 90V D.C. generator is used to charge a battery of 40 cells in series, each cell having an average e.m.f. of 1.9 V and an internal resistance of 0.0025 Ω. If the total resistance of the connecting cells is 1Ω, calculate the value of the charging current (10)

2022/AUG/Q8 **2024/MAY2/Q9** **2024/AUG/Q9** **2025/APR2/Q9**

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JUNE – 2025

Q1. (a) Sketch a circuit diagram for an automatic voltage regulator illustrating how the A.V.R. utilizes a silicon-controlled rectifier to control the excitation system for an alternator. (10) (b) Describe how the A.V.R. monitors output and controls the excitation system. (6)
2024/MAY1/Q1 **2024/OCT/Q1** **2025/JUN/Q1**
Click Here to See the Answer

Q2. Overcurrent protection relays are built into main alternator breakers to safeguard the individual alternators and the distribution system against certain faults. (a) Sketch a typical relay. (8) (b) Describe the operation of the relay sketched in (a) (8)
2024/MAY1/Q2 **2024/OCT/Q2** **2025/JUN/Q2**
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Q3. (a) Sketch and describe a power (watt) meter for an A.C. switchboard. (b) State why type of load governs power factor and give examples of power factor for a resistance load and for normal marine operation. (8)
2024/MAY1/Q3 **2024/OCT/Q3** **2025/JUN/Q3**
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Q4. (a) What is the function of slip rings in an AC motor? (6)
(b) Compare Direct–On-Line (DOL), Star-Delta, and Auto-Transformer methods of motor starting. Which method is preferred and why? (10)
2025/JUN/Q4
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Q5. Write short notes on the following with details of the system and the purpose with neat sketch, as necessary: a) Shaft hull grounding system. (8) b) Rudder grounding system. (8)
2025/JUN/Q5
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Q6. (a) What are the different types of DC motors? (6)

(b) A 10 H.P. 230 V shunt motor takes an armature current of 6A from 230 V mains at no load runs at 1200 r.p.m. The armature resistance is 0.25Ω. Determine speed and electromagnetic torque when the armature takes 36 amps with the same flux. (10)
2024/MAY1/Q6 **2024/OCT/Q6**
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Q7. An amplifier has an open-circuit voltage gain of 1000, an input resistance of 2000 Ω and an output resistance of 1.0 Ω. Determine the input signal voltage required to produce an output signal current of 0.5A in a 4.0Ω resistor connected across the output terminals. If the amplifier is then used with negative series voltage feedback so that one tenth of the output signal is fed back to the input, determine the input signal voltage to supply the same output signal current. (16)
2024/MAY1/Q7 **2024/OCT/Q7**
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Q8. (a) Explain how fluorescent tubes power factor is improved. (6)
(b) A fluorescent lamp taking 80W at 0.7 power factor lagging from a 230V, 50-Hz supply is to be connected to unity power factor. Determine the value of the correcting approach required. (10)
2022/DEC/Q7 **2024/MAY1/Q8** **2024/OCT/Q8**
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Q9. (a) Explain about non-linear resistors with some examples and illustration on how they differ from linear resistor. (6)
(b) A half-wave rectifier is used to supply 50V d.c. to a resistive load of 800Ω. The diode has a resistance of 25 Ω. Calculate a.c. voltage required.
2024/MAY1/Q9 **2024/OCT/Q9**
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JULY – 2025

Q1. Explain with a simple line sketch, a main engine jacket cooling automatic control system capable of maintaining the jacket water temperature within close limits during wide changes in engine load. (16)
2024/JAN/Q1 **2024/JUN/Q1** **2024/NOV/Q1** **2025/FEB/Q1** **2025/JUL/Q1**
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b) Enumerate the disadvantages of an insulated neutral system c) Compare the use of an insulated neutral system as opposed to use of an earthed neutral system with regards to the risk of electric shock from either system.
2023/JUL/Q5 **2024/JUN/Q8** **2024/JAN/Q8** **2024/NOV/Q8** **2025/FEB/Q8** **2025/JUL/Q8**

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Q9. a) Differentiate between resistance, induction and impedance in an a.c. circuit. (6)
b) A circuit is made up from four resistors of value 2Ω, 4Ω, 5Ω and 10Ω connected in parallel. If the current is 8.6A, find the voltage drop across the arrangement and the current in each resistor. (10)
2023/JAN/Q8 **2024/JAN/Q9** **2024/JUN/Q9** **2024/NOV/Q9** **2025/FEB/Q9**
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AUGUST – 2025

Q1. a) What is the meaning of excitation in an alternator? (6) b) Explain a brushless alternator with an insight on how the excitation is achieved in these alternators. (10)
2024/DEC2/Q1 **2025/AUG/Q1**
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Q2. a) What are the differences between synchronous and induction motor?
b) What do you understand by the term 'slip'? (4)
c) How do you check continuity of a circuit? Explain the process in brief.
2024/DEC2/Q2 **2025/AUG/Q2**
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Q3. a) Describe an alkaline battery cell, listing the materials used in its manufacture. (6)
b) With reference to alkaline batteries used on ships, state each of the following: (10)
i) Significance of the relative density reading of the electrolyte.
ii) When the electrolyte would normally be renewed.
iii) Reasons why the voltage reading of this type of battery is not necessarily indicative of its condition.
iv) The normal temperature range and safe temperature limit of battery.
v) Effects of high and low temperature.
2024/DEC2/Q3 **2025/AUG/Q3**
Click Here to See the Answer

Q4. Describe with the aid of a diagram the operation of the following components of electrical equipment and explain the purpose of each. (16)
a) Under voltage protection.
b) Miniature circuit breakers. c) Reverse power tripping.
2024/DEC2/Q4 **2025/AUG/Q4**
Click Here to See the Answer

Q5. With respect to personnel carrying out inspection and maintenance involving entry to boilers and other confined spaces. a) State the precautions needed for the operation of portable electrical tools and lighting, with respect to safety. (10)
b) Outline the routine checks carried out on the equipments. (6)
2024/DEC2/Q5 **2025/AUG/Q5**
Click Here to See the Answer

Q6. a) Discuss the open circuit and short circuit test performed for transformer. (6)
b) The primary and secondary windings of a 30 KVA, 6000/230V, 1-phase transformer have resistance of 10 Ω and 0.016 Ω respectively. The reactance of the transformer referred to the primary is 34 Ω. Calculate the primary voltage required to circulate full load current when the secondary is short circuited. What is the power factor on the short circuit? (10)
2023/AUG/Q6 **2024/DEC2/Q6** **2025/AUG/Q6**
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Q7. a) Explain what do you understand by the term 'transducer'? (6)
b) A coil of resistance 10 ohms and inductance 100mH is connected in series with two parallel capacitors each of value 100 μF across a 250 V, 50Hz supply. determine (10) i) The circuit current ii) The total power factor iii) The power taken from the supply.
2024/DEC2/Q7 **2025/AUG/Q7**
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Q8. a) What is a Zener diode? (6) b) Find the generated e.m.f./conductor of a 6-pole d.c. generator having a magnetic flux/pole of 64m Wb and a speed of 1000 rev/min. If there are 468 conductors, connected in six parallel circuits, calculate the total generated e.m.f. of the machine. Find also the total power developed by the armature when the current in each conductor is 50 A. (10)
2024/DEC2/Q8 **2025/AUG/Q8**
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Q9. a) Sketch a schematic arrangement of a three-phase alternator with star connection. (6)
b) A 500V, 3-phase, star-connected alternator supplies a star-connected induction motor which develops 45kW. The efficiency of the motor is 88 percent and the power factor is 0.9 (lagging). The efficiency of the alternator at this load is 80 percent. Determine
a) the line current
b) the power output of the alternator c) the output power of the prime-mover. (10

2023/AUG/Q9 **2024/DEC2/Q9** **2025/AUG/Q9**

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SEPTEMBER – 2025

Q1. (a) Explain the term single phasing as applied to poly phase induction motors. (4)
(b) State the likely causes of single phasing and the consequences if motors are not adequately protected. (4)
(c) Describe with the aid of sketches THREE methods for motor protection should single phasing occur. (8)
2022/OCT/Q1 **2023/JUL/Q1** **2024/APR1/Q1** **2025/JAN1/Q1** **2025/SEP/Q1**
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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) State why an Earthed neutral system may be earthed through a resistor
(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)
2024/APR1/Q2 **2025/JAN1/Q2** **2025/SEP/Q2**
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Q3. (a) Describe the principle of operation of EACH of the following detecting elements: (8) (i) Bi-metal strips (ii) Thermistors (b) Explain, with the aid of sketches, typical applications where the devices described in (a) may be employed in high voltage electrical systems. (8)
2024/APR1/Q3 **2025/JAN1/Q3** **2025/SEP/Q3**
Click Here to See the Answer

Q4. (a) Sketch the following types of electric motor connections: (8) (i) A star connection (ii) A delta connection
(b) Explain how and why star and delta connections are combined to produce a Star / Delta starter for an electric motor. (8)
2024/APR1/Q4 **2025/JAN1/Q4** **2025/SEP/Q4**
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Q5. (a) State the necessary conditions required prior to the synchronizing of electrical alternators. (6) (b) Describe the type of cumulative damage that may be caused when alternators are incorrectly Synchronized. (6) (c) Explain how the damage referred to in (b) can be avoided/reduced. (4)
2024/APR1/Q5 **2025/JAN1/Q5** **2025/SEP/Q5**
Click Here to See the Answer

Q6. (a) Explain the principle of conservation of charge and its relationship to Kirchoff's current law. (6)
(b) The open-circuit voltage of a cell as measured by a voltmeter of 100 ohm resistance, was 1.5 V, and the p.d. when supplying current to a 10 ohm resistance was 1.25 V, measured by the same voltmeter. Determine the e.m.f. and internal resistance of the cell. (10)
2024/APR1/Q6 **2025/JAN1/Q6** **2025/SEP/Q6**
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Q7. The loads of a 4-wire, 3-phase systems are: Red line to neutral current = 50 A, power factor of 0.707 (lagging) Yellow line to neutral current = 40 A, power factor of 0.866 (lagging) Blue line to neutral current = 40 A, power factor 0.707 (leading). Determine the value of the current in the neutral wire. (16)
2024/APR1/Q7 **2025/JAN1/Q7** **2025/SEP/Q7**
Click Here to See the Answer

Q8. (a) Describe the effect of running an induction motor on reduced voltage.
(b) A motor takes a current of 60 amperes at 230 volts, the power input being 12 kW. Calculate the power component and the reactive component of the input current. (10)
2022/DEC/Q9 **2024/APR1/Q8** **2025/JAN1/Q8** **2025/SEP/Q8**
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Q9. (a) Describe the basic principles of self-excited generators (6)

(b) The armature resistance of a 200 V-shunt motor is 0.4 Ohms and the no-load armature current is 2A. When fully loaded and taking an armature current of 50 A, the speed is 1200 rev/min. Find the noload speed and state the assumption made in the calculation. (10)

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OCTOBER – 2025

Q1. With reference to the protection of electric motors explain EACH of the following: (a) Fuse back up protection (6) (b) How a motor fitted with fuse back up protection may exceed its rated temperature without being tripped by the primary protection (6) (c) The value of current rating at which the over current relay should be set (4)

2024/APR2/Q1 **2024/SEP2/Q1** **2025/APR1/Q1** **2025/OCT/Q1**

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Q2. a) State the conditions which must be satisfied before an A.C generator can be paralleled with live bus-bars. (4)

b) Sketch a lamp-bright configuration for synchronizing lamps. (8)

c) State the advantages and disadvantages of the lamps-bright system over lamps-darks system. (4)

2022/AUG/Q4 **2023/JAN/Q5** **2024/APR2/Q2** **2023/MAR/Q4**
2024/JAN/Q7 **2024/JUN/Q7** **2024/SEP2/Q2** **2024/NOV/Q7**
2025/FEB/Q7 **2025/APR1/Q2** **2025/JUL/Q7** **2025/OCT/Q2**

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Q3. (a) Sketch, the circuit diagram of an instrument used for measuring electrical insulation resistance. (8)

(b) Describe the circuit diagram sketched in (a), explaining how it operates when measuring electrical insulation resistance. (8)

2024/APR2/Q3 **2024/SEP2/Q3** **2025/APR1/Q3** **2025/OCT/Q3**

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Q4. (a) Explain the working principle of an alkaline battery (8)

(b) Compare the alkaline battery with Lead-Acid battery (8)

2023/NOV/Q1 **2024/APR2/Q4** **2024/SEP2/Q4** **2025/APR1/Q4**
2025/OCT/Q4

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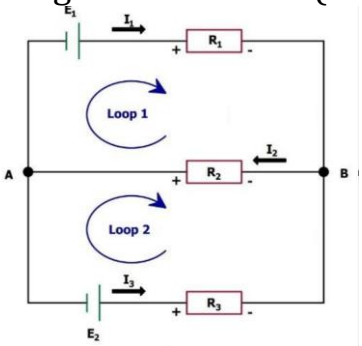
Q5. (a) What is the purpose of AVR in an alternator? (6) (b) With the aid of a simple circuit diagram explain the basic working of a brushless alternator.
2023/NOV/Q4 **2024/APR2/Q5** **2024/SEP2/Q5** **2025/APR1/Q5** **2025/OCT/Q5**
Click Here to See the Answer

Q6. In the following circuit E1 = 13V, E2 = 19.5V, R1 = 5Ω, R2 = 7Ω, R3 = 9Ω: Find the current flowing through each resistor (16)



2023/NOV/Q7 **2024/APR2/Q6** **2024/SEP2/Q6** **2025/APR1/Q6** **2025/OCT/Q6**
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Q7. A 24V emergency battery is to be charged from the 11OV ship's mains when the e.m.f. per cell has fallen to a minimum value of 1.8V. The battery consists of 12 cells in series, has a capacity of 100 Ahr at a 10 hr rate and the internal resistance is 0.03Ω/cell. If charging continues until the voltage per cell rises to 2.2V, find the value of the variable resistor needed to control the charging. The charging current can be assumed to be equal to the maximum allowable discharge current.
2023/NOV/Q8 **2024/SEP2/Q7** **2024/APR2/Q7** **2025/APR1/Q7** **2025/OCT/Q7**
Click Here to See the Answer

Q8. A wooden ring having a mean diameter of 200 mm and a cross-sectional area of 400mm2 is wound uniformly with a coil of 300 turns. If the current passed through the coil is 5A calculate the value of flux produced in the coil. (16)

2023/NOV/Q9 **2024/APR2/Q8** **2024/SEP2/Q8** **2025/APR1/Q8** **2025/OCT/Q8**

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Q9. A coil of resistance 10Ω and inductance 0.1H is connected in series with a capacitor of capacitance 150pF, across a 200V, 50Hz supply. Calculate:
(a) The inductive reactance (3)
(b) The capacitive reactance (3)
(c) The circuit impedance (2)
(d) The circuit current (2)
(e) The circuit power factor (2)
(f) The voltage drop across the coil (2)
(g) The voltage drop across the capacitor (2)

2023/NOV/Q6 **2024/APR2/Q9** **2024/SEP2/Q9** **2025/APR1/Q9** **2025/OCT/Q9**

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NOVEMBER – 2025

Q1. (a) Sketch a circuit diagram for an automatic voltage regulator illustrating how the A.V.R. utilizes a silicon-controlled rectifier to control the excitation system for an alternator. (10)
(b) Describe how the A.V.R. monitors output and controls the excitation system. (6)
2024/MAY1/Q1 **2024/OCT/Q1** **2025/JUN/Q1** **2025/NOV/Q1**
Click Here to See the Answer

Q2. Overcurrent protection relays are built into main alternator breakers to safeguard the individual alternators and the distribution system against certain faults.
(a) Sketch a typical relay. (8)
(b) Describe the operation of the relay sketched in (a) (8)
2024/MAY1/Q2 **2024/OCT/Q2** **2025/JUN/Q2** **2025/NOV/Q2**
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Q3. (a) Sketch and describe a power (watt) meter for an A.C. switchboard.
(b) State why type of load governs power factor and give examples of power factor for a resistance load and for normal marine operation. (8)
2024/MAY1/Q3 **2024/OCT/Q3** **2025/JUN/Q3** **2025/NOV/Q3**
Click Here to See the Answer

Q4. (a) What is the function of slip rings in an AC motor? (6)
(b) Compare Direct–On-Line (DOL), Star-Delta, and Auto-Transformer methods of motor starting. Which method is preferred and why? (10)
2025/JUN/Q4 **2025/NOV/Q4**
Click Here to See the Answer

Q5. Write short notes on the following with details of the system and the purpose with neat sketch, as necessary: a) Shaft hull grounding system. (8)
b) Rudder grounding system. (8)

2025/JUN/Q5 **2025/NOV/Q5**
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Q6. (a) What are the different types of DC motors? (6) (b) A 10 H.P. 230 V shunt motor takes an armature current of 6A from 230 V mains at no load runs at 1200 r.p.m. The armature resistance is 0.25Ω. Determine speed and electromagnetic torque when the armature takes 36 amps with the same flux. (10)
2024/MAY1/Q6 **2024/OCT/Q6** **2025/NOV/Q6**
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Q7. An amplifier has an open-circuit voltage gain of 1000, an input resistance of 2000 Ω and an output resistance of 1.0 Ω. Determine the input signal voltage required to produce an output signal current of 0.5A in a 4.0Ω resistor connected across the output terminals. If the amplifier is then used with negative series voltage feedback so that one tenth of the output signal is fed back to the input, determine the input signal voltage to supply the same output signal current. (16)
2024/MAY1/Q7 **2024/OCT/Q7** **2025/NOV/Q7**
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Q8. (a) Explain how fluorescent tubes power factor is improved. (6)
(b) A fluorescent lamp taking 80W at 0.7 power factor lagging from a 230V, 50-Hz supply is to be connected to unity power factor. Determine the value of the correcting approach required. (10)
2022/DEC/Q7 **2024/MAY1/Q8** **2024/OCT/Q8** **2025/NOV/Q8**
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Q9. (a) Explain about non-linear resistors with some examples and illustration on how they differ from linear resistor. (6)
(b) A half-wave rectifier is used to supply 50V d.c. to a resistive load of 800Ω. The diode has a resistance of 25 Ω. Calculate a.c. voltage required.
2024/MAY1/Q9 **2024/OCT/Q9** **2025/NOV/Q9**
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DECEMBER – 2025

Q1. (a) How busbar inspection and maintenance is carried out. (10)
(b) What are safety precautions taken while doing maintenance on the busbar?
2023/FEB/Q5 **2024/DEC1/Q1** **2025/MAR/Q1** **2025/DEC/Q1**
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Q2. Draw and explain the shape of the characteristic curve of a p-n junction diode in forward and reverse bias modes (16)
2022/AUG/Q2 **2022/SEP/Q2** **2023/MAR/Q2** **2024/DEC1/Q2** **2025/MAR/Q2** **2025/DEC/Q2**
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Q3. a) Explain the working of a Megger with the aid of its internal circuit.
b) What safety measures are taken while using a Megger? (4)
2023/MAY1/Q2 **2023/SEP/Q3** **2024/DEC1/Q3** **2025/MAR/Q3** **2025/DEC/Q3**
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Q4. a) What is the purpose of preferential Tripping system on ship's electrical network? (6)
b) Explain the various stages of preferential trips including the loads connected to those stages. (10)
2023/MAY1/Q3 **2024/DEC1/Q4** **2025/MAR/Q4** **2025/DEC/Q4**
Click Here to See the Answer

Q5. a) The current transformer (CT) and potential transformer (PT) or voltage transformer are both measuring devices. List their shipboard application. b) Sketch and describe any one type of current transformer
2023/MAY1/Q4 **2024/DEC1/Q5** **2025/MAR/Q5** **2025/DEC/Q5**

Q6. a) What are the safety devices provided on the steering gear system? (10) b) What is the significance of the shaft hull earthing device on the shafting? (6)
2024/DEC1/Q6 **2025/MAR/Q6** **2025/DEC/Q6**
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Q7. a) Explain Fleming's Right hand rule. (6)
b) A one-turn armature coil has an axial length of 0.4m and a diameter of 0.2m. It is rotated at a speed 500 rev/min in a field of uniform flux density of 1.2 T. Calculate the magnitude of the e.m.f. induced in the coil. (10)
2023/JUN/Q9 **2024/DEC1/Q7** **2025/MAR/Q7** **2025/DEC/Q7**
Click Here to See the Answer

Q8. a) Describe in detail the method used to measure the capacitance of a capacitor. (6)
b) A circuit has a resistance of 3R and an inductance of 0.01 H. The voltage across its ends is 60V and the frequency is 50Hz. Calculate (i) the impedance.
(ii) the power factor
(iii) the power absorbed. (10)
2023/JUN/Q8 **2024/DEC1/Q8** **2025/MAR/Q8** **2025/DEC/Q8**
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Q9. a) What is the difference between a DC Generator and a DC motor? (6)
b) A 4-pole, 32 conductor, Lap-wound DC shunt generator with terminal voltage of 200 V delivering 12 A to the load has ra = 2 and field circuit resistance of 200 Ω. It is driven at 1000 RPM.
i) Calculate the flux per pole in the machine.
ii) If the machine has to be run as a motor with the same terminal voltage and drawing 5 A from mains, maintaining the same magnetic field, find the speed of the machine. (10)
2023/JUN/Q7 **2024/DEC1/Q9** **2025/MAR/Q9** **2025/DEC/Q9**
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