D. MARINE
Study Material

MEO CLASS 4 WRITTEN: MET

(MARINE ELECTRO TECNOLOGY)

FOR INDIAN COMPETENCY EXAM

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Study Material

JANUARY – 2023

Q1. a) State Ohm's Law. (3)
b) State the limitations of Ohm's Law. (3)
c) If the resistance of a circuit is increased to 3 times and the applied Voltage is halved what will happen to the circuit current? (10)
2023/MAY1/Q1
Click Here to See the Answer

Q2. 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
Click Here to See the Answer

Q3. a) What is the purpose of preferential Tripping system on ship's electrical network? (6)
b) Explain the various stages of preferential trips with the loads connected to those stages. (10
2023/MAY1/Q3
Click Here to See the Answer

Q4. 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
Click Here to See the Answer

Q5. a) What is single phasing of a 3 ph induction motor? (6)
b) What are the causes of single phasing? (6)
c) Explain any method of protection against single phasing? (4)
2023/MAY1/Q5
Click Here to See the Answer

Q6. a) What is difference between EMF and PD of a battery. (6)
b) Calculate the value of I1 in the following circuit. (10)

2023/MAY1/Q6
Click Here to See the Answer

Q7. a) What is self-induction? (6)
b) A coil of 800 turns is wound on a wooden former and a current of 5A is passed through it to produce a magnetic flux of 200 micro-webers. Calculate the average value of e.m.f. induced in the coil when the current is i) switched off in 0.08 seconds ii) reversed in 0.2 seconds. (10)
2023/MAY1/Q7
Click Here to See the Answer

Q8. a) What are the routine maintenance carried out on lead acid batteries? (6) b) When a 10 Ω resistor is connected across a battery, the current is measured to be 0.18 A. If similarly tested with a 25 Ω resistor, the current is measured to be 0.08A. Find the e.m.f. of the battery and its internal resistance. Neglect the resistance of the ammeter used to measure the current. (10)
2023/MAY1/Q8
Click Here to See the Answer

Q9. a) Name the various types of capacitors? (6)
b) A 500W, 100V bulb is to be connected across 250V, 50Hz mains. Find the value of the capacitor required to be connected in series. (10)
2023/MAY1/Q9
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JUNE – 2023

Q1. Derive the formula for total resistance of a circuit containing 3 resistors in A) Series, B) Parallel. (16)
2023/JUN/Q1
Click Here to See the Answer

Q2.a) What are the protections provided for the electrical equipment of ship's steering gear? (8) b) Describe steering gear tests and drills? (8)
2023/JUN/Q2
Click Here to See the Answer

Q3. a) Sketch and describe the working of a Lead-Acid battery. (12)
b) What routine maintenance is carried out on these batteries? (4)
2023/JUN/Q3
Click Here to See the Answer

Q4. a) How is the Synchroscope connected for paralleling operation of alternator? (8) b) Explain lamp bright method used to paralleling alternators. (8)
2023/JUN/Q4
Click Here to See the Answer

Q5. a) What is high voltage and what are the high voltage equipment? (6)
b) Briefly explain the safety requirements of high voltage system. (10)
2023/JUN/Q5
Click Here to See the Answer

Q6. a) State Ohm's Law. (3)
b) State the limitations of Ohm's Law. (3) c) 3 resistors of value 2 Ω, 4 Ω and 8 Ω are connected in series across a supply of 42 V. Find the current taken from supply and voltage drop across each resistor. (10)
2023/JUN/Q6
Click Here to See the Answer

Q7. 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 . a) Calculate the flux per pole in the machine. (6)
b) 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

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 (a) the impedance. (b) the power factor (c) the power absorbed. (10)

2023/JUN/Q8

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Q9. 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

Click Here to See the Answer

JULY – 2023

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. (6) c) Describe with the aid of sketches THREE methods for motor protection should single phasing occur. (6)

2023/JUL/Q1

Click Here to See the Answer

Q2. Explain clearly why, in D.C. installation, a compound-wound electric generator is usually adopted for ship lighting purposes. Compare it's performance with that of shunt and series wound machines. What attention does such a machine require when working and what care is necessary for its maintenance in a satisfactory condition? (16)

2023/JUL/Q2

Click Here to See the Answer

Q3. With reference to the protection of electric motors explain EACH of the following in relation to fuse back up protection. a) How a motor fitted with fuse back up protection may exceed its rated temperature without being tripped by the primary protection. (8) b) The value of current rating at which the over current relay should be set. (8)

2023/JUL/Q3

Click Here to See the Answer

Q4. With the aid of a block diagram, briefly describe the effect which negative voltage feedback has on an amplifier and state the advantages resulting from the use of negative feedback. (16)

2023/JUL/Q4

Click Here to See the Answer

Q5. 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) Compare the use of an insulated neutral system as opposed to the use of an Earthed neutral system with regards to the risk of electric shock from either System. (4)

2023/JUL/Q5

Click Here to See the Answer

Q6. The open-circuit voltage of a cell as measured by a voltmeter of 100 Ω resistance, was 1.5V, and the p.d. when supplying current to a 10 Ω resistance was 1.25V, measured by the same voltmeter. Determine the e.m.f. and internal resistance of the cell. (16)

2023/JUL/Q6

Click Here to See the Answer

Q7. A moving-coil instrument has a resistance of 10 Ω and requires a current of 15 mA to give fullscale deflection. Calculate the resistance value of the resistor necessary to enable it to be used to measure a) currents up 25A b) voltages up to 500V. (16)

2023/JUL/Q7

Click Here to See the Answer

Q8. Find the length of manganese wire required to make a 15.7 Ω resistor, if the diameter is 0.315 mm and the resistivity is 407 μΩ mm (16)

2023/JUL/Q8

Click Here to See the Answer

Q9. A 105V, 3kW d.c. shunt motor has a full-load efficiency of 82 percent. The armature and field resistances are 0.25 Ω and 90 Ω respectively. The full-load speed of the motor is 1000 rev/min. Neglecting armature reaction and brush drop, calculate the speed at which the motor will run at no load if the line current at no load is 3.5A. calculate the resistance to be added to the armature circuit, in order to reduce the speed to 800 rev/min, the torque remaining constant at full-load value. (16)

2023/JUL/Q9

Click Here to See the Answer

AUGUST – 2023

Q1. Describe an electric telegraph system and describe its operation. (16)
2023/AUG/Q1
Click Here to See the Answer

Q2. (a) (i) Describe with the aid of a sketch the operation of a synchroscope. ii) State the information obtained from it. (8) b) Suggest a substitute in the event of synchroscope and stand by light failure. (8)
2023/AUG/Q2
Click Here to See the Answer

Q3. Explain the possible consequences if the following electrical current faults are not rectified: - (16) a) Earth current leakage. b) Currents induced into the shafting of rotating machinery c) Overload currents
d) Arcing at contact terminals.
e) Short circuit currents
2023/AUG/Q3
Click Here to See the Answer

Q4. 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. (16)
2023/AUG/Q4
Click Here to See the Answer

Q5. a) State the conditions, which must be satisfied before an a.c. generator can be paralleled with live bus bars. (8) b) After an a.c. generator has been paralleled explain how the following are achieved for the incoming generator i) correct kW load sharing. (4) ii) correct load current when the generator has power factor different to the other generators. (4)
2023/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
Click Here to See the Answer

Q7. a) Describe the principle of variable-capacitance 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.
2023/AUG/Q7
Click Here to See the Answer

Q8. a) Describe the means by which the magnetic flux associated with a conductor may be changed. (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)
2023/AUG/Q8
Click Here to See the Answer
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.
2023/AUG/Q9
Click Here to See the Answer

SEPTEMBER – 2023

Q1. a) What are the effects of voltage and frequency changes on transformer functioning? (8)
b) State the various energy losses in transformers. (8)
2023/SEP/Q1
Click Here to See the Answer

Q2. a) Distinguish between primary and secondary cells. (4)
b) Explain Internal resistance in a battery. (4)
c) What are the factors affecting internal resistance of a battery. (8)
2023/SEP/Q2
Click Here to See the Answer

Q3. a) Explain the working of a Megger with the aid of its internal circuit. (12) b) What safety measures are taken while using a Megger? (4)
2023/MAY1/Q2 **2023/SEP/Q3**
Click Here to See the Answer

Q4. a) What are the regulations regarding Emergency Generator onboard a cargo ship? (6)
b) Describe the functioning of the emergency generator with the help of a flow chart. (10)
2023/SEP/Q4
Click Here to See the Answer

Q5. Write short notes on a) short circuit protection to Induction motors (8)
b) Overload protection to induction motors (8)
2023/SEP/Q5
Click Here to See the Answer

Q6. a) State Ohm's Law. (3) b) State the limitations of Ohm's Law. (3) c) If the resistance of a circuit is increased to 3 times and the applied Voltage is halved, what will happen to the circuit current? (10)
2023/MAY1/Q1 **2023/SEP/Q6**

Click Here to See the Answer

Q7. a) What is the difference between EMF and PD of a battery. (6) b) Calculate the value of I1 in the following circuit.
2023/MAY1/Q6 **2023/SEP/Q7**
Click Here to See the Answer

Q8. Derive the formula for total resistance of a circuit containing 3 resistors in a) Series (8) b) Parallel (8)
2023/JUN/Q1 **2023/SEP/Q8**
Click Here to See the Answer

Q9. a) Define Work, power and efficiency (6)
b) A battery is charged with a constant current of 16 amperes for 11 hours after which time it is considered to be fully charged, its voltage per cell being recorded as 2.2V. Find its ampere hour efficiency if it is (1) Discharged at a rate of 16 amperes for 10 hours, and (2) 28 amperes for 4 hours. In either case discharge was discontinued when the voltage per cell fell to 1.8 V. (10)
2023/SEP/Q9
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OCTOBER – 2023

Q1. a) Name the factors the resistance of a conductor depends on? (4)
b) Describe three types of resistive strain gauge. (6)
c) Explain the working of a strain gauge used for pressure measurement.
2023/OCT/Q1
Click Here to See the Answer

Q2. a) Distinguish between primary and secondary cells. (4)
b) Explain Internal resistance in a battery. (4)
c) What are the factors affecting internal resistance of a battery. (8)
2023/SEP/Q2 **2023/OCT/Q2**
Click Here to See the Answer

Q3. a) Compare direct current with alternating current. (6)
b) With respect to alternating voltage wave form, explain the following terms: time period, frequency, Cycle, Peak Value, Peak to peak value. (10)
2023/OCT/Q3
Click Here to See the Answer

Q4. a) Sketch and describe moving iron and moving coil instruments for measuring current. (10)
b) How the moving iron instrument can be used to measure voltage? (6)
2023/OCT/Q4
Click Here to See the Answer

Q5. Write a short note on any two of the following: a) Voltmeter.
b) multi-meter. c) Megger. (16)
2023/OCT/Q5
Click Here to See the Answer

Q6. The resistors 5Ω, 7Ω, and 8Ω are connected in series across a voltage source of 10 V. Find the voltage drop across each resistor and also the total power consumed by the circuit. (16)
2023/OCT/Q6

Click Here to See the Answer

Q7. Ten thousand cubic millimeters of copper are a) Drawn into a wire 100 metres long, b) Rolled into a square sheet of 100 mm side. Find the resistance of the wire and the resistance between opposite faces of the plate, if the resistance of the copper is 17 μΩmm or 1.7 x 10-8 ohms-metres.

2023/OCT/Q7

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Q8. Find the p.d between A-B and B-C shown in the figure below. (16)

2023/OCT/Q8

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Q9. The following are the results of measurements taken at intervals over a half cycle of alternating voltage:

Time (t milliseconds)	0	0.45	0.95	1.5	2.1	2.5	3.1	3.9	4.5	5.0
Voltage (V volts)	0	20	36	40	37.5	33	32	31	20	0

Calculate the r.m.s value, average value and frequency of the wave. (16)

2023/OCT/Q9

Click Here to See the Answer

NOVEMBER – 2023

Q1. a) Explain the working principle of an alkaline battery. (8)
b) Compare the alkaline battery with Lead-Acid battery. (8)
2023/NOV/Q1
Click Here to See the Answer

Q2. With the aid of a circuit diagram, explain how a Galvanometer can be used as a Voltmeter. (16)
2023/NOV/Q2
Click Here to See the Answer

Q3. a) What are the benefits of 3 Ph supply over a single-phase supply system? (6) b) Explain 3-wire and 4-wire 3 phase a.c. distribution systems.
2023/NOV/Q3
Click Here to See the Answer

Q4. 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. (10)
2023/NOV/Q4
Click Here to See the Answer

Q5. a) Explain the working principle of a synchronous motor. (6) b) What are the starting methods of a synchronous motor? (4) c) List the merits and demerits of synchronous motor over induction motor. (6)
2023/NOV/Q5
Click Here to See the Answer

Q6. A coil of resistance 10 ohm and inductance 0.1H is connected in series with a capacitor of capacitance 150pF, across a 200 V, 50 Hz 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

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Q7. In the following circuit, E1 = 13 V, E2 = 19.5 V, R1 = 5 Ω, R2 = 7 Ω, R3 = 9 Ω. Find the current flowing through each resistor. (16)

2023/NOV/Q7

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Q8. A 24 V emergency battery is to be charged from the 110 V ship's mains when the e.m.f. per cell has fallen to a minimum value of 1.8 V. The battery consists of 12 cells in series, has a capacity of 100 Ahr at a 10 hr rate and the internal resistance is 0.03 ohm/cell. If charging continues until the voltage per cell rises to 2.2 V, 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. (16)

2023/NOV/Q8

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Q9. A wooden ring having a mean diameter of 200 mm and a cross-sectional area of 400 mm2 is wound uniformly with a coil of 300 turns. If the current passed through the coil is 5 A calculate the value of flux produced in the coil. (16)

2023/NOV/Q9

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DECEMBER – 2023

Q1. With reference to emergency source of electrical power in cargo ships:
a) Describe a typical power source (6)
b) Give a typical list of essential services, which must be supplied simultaneously. (5)
c) Explain how the emergency installation can be periodically tested. (5)
2023/DEC/Q1
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Q2. a) Sketch a reverse current trip. (8) b) Explain briefly how the reverse current trip operates. (4)
c) Explain why there is a time delay incorporated before the reverse current trip operates. (4)
2023/DEC/Q2
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Q3. a) Briefly discuss the conditions that needs to be satisfied for synchronizing (8)
b) Explain, working of a synchroscope with the help of a sketch. (8)
2023/DEC/Q3
Click Here to See the Answer

Q4. a) Sketch and describe a star-delta starter for starting an induction motor (10) b) Three similar coils, each having a resistance of 10 ohms and an inductance of 0.02 H are connected in i) Star ii) Delta to a 3-phase, 50-Hz supply with 500V Calculate the total power absorbed and the line current in each case. (6)
2023/DEC/Q4
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Q5. A 4-pole lap wound DC shunt generator has an open e.m.f of 250V when the flux per pole is 0.08 Wb and the speed is 10 rev/ sec. The speed of the generator is reduced to 10 per cent and the flux per pole is increased by 5% when the generator supplies a load of 100A. Determine the terminal

voltage, if the armature resistance is 0.06 ohms and the new total field circuit resistance is 200 ohm. (16)

2023/DEC/Q5

Click Here to See the Answer

Q6. a) Describe a simple single-phase transformer. (6)
b) A 15 KVA, 440 / 110- volt, 50 Hz cycle/sec, single-phase transformer has primary and secondary resistance of 0.12 ohm and 0.0077 ohm respectively. The iron loss of the transformer is 0.16 kW. Calculate the efficiency of the transformer (10) i) On full load unity power factor ii) on 80 per cent full load at a power factor of 0.9 lagging

2023/DEC/Q6

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Q7.a) Name the three main types of a.c. motor and explain the use to which they are put in marine engineering. (6) b) A four-pole motor is fed at 440V and takes a armature of 50 A. The resistance of the armature circuit is 0.28 ohm. The armature winding is wave connected with 888 conductors and the useful flux per pole is 0.023 Wb. Calculate the speed. (10)

2023/DEC/Q7

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Q8. a) List the parts of an alternator fitted with temperature alarms. (6)
b) Explain why heaters are fitted to an Alternator. (6)
c) Explain the function of an automatic voltage regulator. (4)

2023/DEC/Q8

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Q9. a) What is meant by the term 'back e.m.f.' as applied to an electric motor? (6)
b) A 40 kW,220V shunt motor has a full-load efficiency of 90 per cent, an armature resistance of 0.075 ohms and a shunt motor-field resistance of 55 ohms. When 'at starting', the starter handle is moved onto the first stud, it is desired to limit the current, through the armature to 1.5 times the value which it has when the motor is on full load. What must be the total value of the starting resistance? If, on overload, the speed falls to 90 per cent of its

normal full-load value. What would be the armature current? Neglect the effect of armature reaction. (10)

2023/DEC/Q9

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