D. MARINE
Study Material

ELECTRO TECHNICAL OFFICER : WRITTEN

FOR INDIAN COMPETENCY EXAM

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JAN-2024
SECTION - I

Q1With respect to the High Voltage power systems installation, explain the different types of circuit breaker that are used, comparing them on merits and de-merits. Describe the theory of arc phenomenon and the mechanism fitted to mitigate the arc. (16)

2023/SEP/Q3 **2024/JAN/Q1**

Click Here to See the Answer

Q2. Under what conditions can you produce sustained oscillations? Classify oscillations with respect to frequency range, principle involved, etc. It is possible to produce oscillations with RC networks in phase shift oscillator. Discuss in detail. (16)

2023/JAN/Q2 **2023/APR/Q1** **2024/JAN/Q2**

Click Here to See the Answer

Q3. With reference to the condition monitoring of electrical machinery:
(a) State the important parameters that may be recorded. (8)
(b) Explain how the parameters are measured and what defects may be revealed. (8)

2024/JAN/Q3

Click Here to See the Answer

SECTION II

Q4. (a) Describe the normal criteria used for setting thermal protection relays and their advantage compared to magnetic types.
(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 Ω. When connected to a 220V, 50Hz, a.c. supply the current taken is at first 2A, and when the plunger is drawn into the 'full-in" position the current falls to 0.7A, 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.

2024/JAN/Q4
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Q5. (a) State briefly. The meaning of the expressions 'star-connected' as applied to three -phase a.c. practice. What is the ratio of the maximum line voltage to the maximum phase voltage in each case. (6)
(b) Determine the line current taken by a 440 V, three-phase, star-connected motor having an output of 45 Kw at 0.88 (lagging) power factor and an efficiency of 93 per cent. (10)
2024/JAN/Q5
Click Here to See the Answer

Q6. (a) Why is it important to maintain high efficiency of operation and low values of voltages regulation for power transformers? (6)
(b) A 20 KVA, 2000/220V, single-phase transformer has a primary resistance of 2.1 Ω and a secondary resistance of 0.026 Ω, the corresponding leakage reactance's are 2.5 Ω and 0.03 Ω. Estimate the regulation at full load under power-factor conditions of, (i) unity (ii) 0.5 (lagging) (iii) 0.5 (Leading) (10)
2024/JAN/Q6
Click Here to See the Answer

SECTION - III

Q7. Write short notes on following:
(a) Role of Classification Society on ship who act as Recognized Organization.
(b) Enhanced survey program (ESP) and its applicability (5)
(c) Condition of Class (COC). (5)
2024/JAN/Q7
Click Here to See the Answer

Q8. Name various statutory Certificates and Documents to be carried on board Chemical Tankers giving reference to the conventions and justify for their requirement. (16)
2023/OCT/Q7 **2024/JAN/Q8**
Click Here to See the Answer

Q9. With respect to the hazardous areas of tankers.
(a) Explain the term flameproof (Ex d) for electrical equipment. (6)
(b) State the type of electrical equipment that would be protected in this way.
(c) List likely defects of flameproof equipment.
2020/MAR/Q9 **2020/OCT/Q9** **2021/FEB/Q8** **2021/APR1/Q7**
2021/OCT/Q9 **2022/APR/Q8** **2022/JUL/Q9** **2023/JUL/Q8** **2024/JAN/Q9**
Click Here to See the Answer

FEB-2024

SECTION - I

Q1. (a) Compare methods of obtaining speed regulation of three-phase induction motor generally used in tankers by means of: (16)
i. Rotor resistance.
ii. Cascade system.
iii. Pole-changing.
Give examples where each system may be employed with advantage.
2023/SEP/Q1 **2023/DEC/Q1** **2024/FEB/Q1**
Click Here to See the Answer

Q2. 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 change and braking are achieved. (8)
2023/AUG/Q2 **2024/FEB/Q2**
Click Here to See the Answer

Q3. With reference to preferential tripping in a marine electrical distribution system.
a) With the aid of a sketch, describe a typical arrangement to provide three stages of tripping an instantaneous protection against short circuit. (10)
b) State why this protection is required. (6)

2024/FEB/Q3
Click Here to See the Answer

SECTION - II

Q4. a) What are the factors which determine the synchronous speed of a motor? (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.
2024/FEB/Q4
Click Here to See the Answer

Q5. 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 ohm. 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)
2023/FEB/Q5 **2023/JUL/Q5** **2024/FEB/Q5**
Click Here to See the Answer

Q6. 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/FEB/Q6 **2023/JUL/Q6** **2024/FEB/Q6**
Click Here to See the Answer

SECTION - III

Q7. What is meant by "Control and Management of Ships ballast water and sediments" Why is this term so significant with reference to shipping in recent times. (16)
2024/FEB/Q7
Click Here to See the Answer

Q8. a) State the hazards which may be encountered when entering an enclosed space and the precautions that should be taken. (5)
b) Sketch and describe an oxygen analyser which can be used to sample the atmosphere in void or closed spaces. (5)
c) Instruction given to person entering the enclosed space as per the ISM procedures. (6)
2022/NOV/Q7 **2024/FEB/Q8**
Click Here to See the Answer

Q9. With respect to MARPOL 73/78, Annex-ll, Noxious liquid chemicals are divided into categories.
a) State the number of categories, and what does each category signify. (8)
b) State the requirement of procedures and Arrangements Manual, and what information is available.
Click Here to See the Answer

MARCH-2024
SECTION – I

Q1. a) Explain why it is necessary to have reverse power protection for alternators intended for operation. (6)

b) (i) Sketch a reverse power trip. (5)
(ii) Briefly explain the principle on which the operation of this power trip is based and how tripping is activated. (5)
2021/JAN/Q2 **2022/FEB/Q3** **2022/N OV/Q1** **2024/MAR/Q1**
Click Here to See the Answer

Q2. A. Describe a brush less alternator with a.c. exciter static A.V.R. (8)
B. State the output voltage characteristics for this type of machine. (8)
2024/MAR/Q2
Click Here to See the Answer

Q3. (a) Which of the following devices will prevent a DC generator from becoming motorized?
(i) Over current relay (4)
(ii) Motorization trip (4)
(iii) Reverse power relay (4)
(iv) Reverse current relay. (4)
(b) Give a detailed explanations as to why the remaining options were not considered. (8)
2023/JAN/Q3 **2024/MAR/Q3**
Click Here to See the Answer

Q4. a) What is a commutator? Discuss its rectifying action in detail. (6)
(b) Determine the line current taken by a 440 V, three-phase, star-connected motor having an output of 45 Kw at 0.88 (lagging) power factor and an efficiency of 93 per cent. (10)
2024/MAR/Q4
Click Here to See the Answer

SECTION - II

Q5. a) Describe the effects of changes in speed, rotor current and torque as load is applied to an induction motor. How does the motor adjust its stator current with changes in mechanical load? (6)

b) A 20 KVA, 2000/220V, single-phase transformer has a primary resistance of 2.1 Ω and a secondary resistance of 0.026 Ω. The corresponding leakage reactance's are 2.5 Ω and 0.03 Ω. Estimate the regulation at full load under power-factor conditions of:
(i) Unity
(ii) 0.5 (lagging)
(iii) 0.5 (Leading) (10)
2024/MAR/Q5
Click Here to See the Answer

Q6. a) Which of the following three motors has the poorest speed regulation: shunt motor, series Motor or cumulative compound motor? Explain. (6)
b) An 18.65 KW,4-pole,50HZ, 3 phase induction motor has friction and windage losses of 2.5 percent
of the output. The full load slip is 4% compute for full load
(i) the rotor Cu loss
(ii) the rotor input
(iii) the shaft torque
(iv) the gross electromagnetic torque. (10)
2024/MAR/Q6
Click Here to See the Answer

SECTION - III

Q7. Write reference to gravity lifeboat davits; state the purpose of the following:
a) Centrifugal brake.
b) Dead man's handle.
c) Davit limit switch. (16)
2022/DEC/Q9 **2024/MAR/Q7**
Click Here to See the Answer

Q8. In engine rooms that are operated under UMS conditions describe with the aid of sketches how the following are monitored: (8)
a) The perforation of a high-pressure fuel pipe.

b) Periodical maintenance checks and tests require to be done to verify the effectiveness of the above system. (8)
2024/MAR/Q8
Click Here to See the Answer

Q9. With reference to MARPOL Annex IV
a) Draw a biological sewage treatment plant and explain the principle of operation. (8)
b) Periodical maintenance and checks and tests required to be done to verify the effectiveness of the above system. (8)
2021/JAN/Q7 **2021/MAR/Q9** **2021/DEC/Q7** **2022/JUL/Q8** **2023/NOV/Q7** **2020/OCT/Q7** **2024/MAR/Q9**
Click Here to See the Answer

APRIL-2024

Q1. 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)
2022/NOV/Q2 **2023/APR/Q2** **2024/APR/Q1**
Click Here to See the Answer

Q2. 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.
2024/APR/Q2
Click Here to See the Answer

Q3. What is soft starting of an Induction Motor? Describe with a circuit using thyristors used for soft starting. Discuss its advantages and disadvantages.
2023/JUL/Q3 **2024/APR/Q3**
Click Here to See the Answer

SECTION - II

Q4. 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/Q4 **2024/APR/Q4**
Click Here to See the Answer

Q5. 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 240 V 60 W lamps connected in the usual manner. The potential difference at the busbars is 220 V. 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:
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 60 W rating.
2022/DEC/Q5 **2024/APR/Q5**
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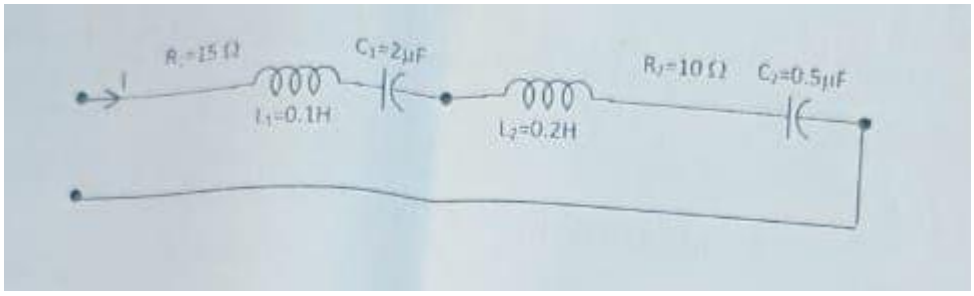
Q6. (a) Sketch an arrangement showing the principal of a proportional plus Integral (P + I) control loop.
(b) Compare the series and parallel resonance circuits. Find the frequency at which the following circuit resonates. (10)



2023/APR/Q5 **2023/SEP/Q4** **2024/APR/Q6**
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SECTION - III

Q7. Discuss the following with respect to International Safety Management (ISM) code:
A. Emergency preparedness, drills and 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/Q7
Click Here to See the Answer

Q8. 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)
2024/APR/Q8
Click Here to See the Answer

Q9. Petroleum vapours are dangerous substances and when mixed with air can be ignited.
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 (5)
iii) state one reason that may cause the explosimeter to give a false reading
b) for flammable mixtures, explain the meaning of the terms lower and upper flammable limits. (6)
2024/APR/Q9
Click Here to See the Answer

JUNE-2024

Q1. What are semiconductor devices? What are its advantages over thermionic devices? With respect to semiconductor devices describe working principle and application of the following: (16)
(a) Zener Diode
(b) Transistor
(c) Photocell
(d) Thyristor
2022/APR/Q3 **2022/JUN/Q3** **2023/OCT/Q1** **2024/JUN/Q1**
Click Here to See the Answer

Q2. Diesel electric propulsion is now being chosen as the power plant for an increasingly wide variety of vessels. (16)
a) Sketch a simple layout of such an installation.
b) Explain the advantages of selecting such a plant.
2022/APR/Q2 **2023/NOV/Q1** **2024/JUN/Q2**
Click Here to See the Answer

Q3. With reference to an emergency source of electrical power in cargo ships:
a) Describe a typical power source. (8)
b) Give a typical list of essential services, which must be supplied simultaneously. Explain how the
emergency installation can be periodically tested. (8)
2021/MAR/Q1 **2023/NOV/Q2** **2024/JUN/Q3**
Click Here to See the Answer

SECTION - II

Q4. With respect to circuit breakers:
a) Compare the effectiveness of a current limiting circuit breaker with that of a HRC fuse. (6)
b) A coil having a resistance of 10 ohm and an inductance of 0.15 H is connected in series with a capacitor across a 100 V, 50 Hz supply. If the current and the voltage are in phase what will be the
value of the current in the circuit and the voltage drop across the coil? (10)
2021/JAN/Q5 **2021/DEC/Q5** **2022/FEB/Q4** **2024/JUN/Q4**
Click Here to See the Answer

Q5. With reference to three phase induction motors:
a) Explain the phenomenon of crawling and cogging in these motors (6)
b) A three-phase induction motor is wound for four poles and is supplied from a 50 Hz System calculate:
a) The synchronous speed
b) The speed of rotor when the slip is 4 per cent.
c) The rotor frequency when the speed of the rotor is 600 r/min. (10)
2024/JUN/Q5
Click Here to See the Answer

Q6. a) Describe the working of a single-phase full wave rectifier with a resistive load. Draw the load voltage and current waveforms. (8)
b) Diode half wave rectifier supply a resistive load of 100Ω from a 100 V ac r.m.s voltage source. The diode is a resistance of 5Ω during conduction state. Calculate
i) The DC output voltage
ii) DC average load current (8)
2020/OCT/Q6 **2021/APR1/Q4** **2021/JUL2/Q4** **2021/DEC/Q4** **2024/JUN/Q6**
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SECTION - III

Q7. What statutory certificates need to be carried by an Indian flagged general cargo vessel? Name the certificates and state the validity of each of the certificates. (16)
2024/JUN/Q7
Click Here to See the Answer

Q8. For an ISM certification, explain the key clauses, which are required to be complied with obtaining Interim DOC, State the responsibility of a ETO with respect to satisfactory implementation of SMS on board ship. (16)
2024/JUN/Q8
Click Here to See the Answer

Q9. a) Sketch a line diagram of a mechanical low expansion foam fixed firefighting system suitable for machinery spaces. (6)
b) Describe the operation of the system sketched. (6)
c) Explain how a mixture of foam making compound and sea water are converted into foam. (4)
2024/JUN/Q9
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JULY-2024

Q1. a) What is intrinsic electric safety? Discuss the specific maintenance protocols, inspections, and safety measures required to ensure the reliability and safety of such equipment on board ship. (8)
b) Describe intrinsically safe equipment used on board ship. (8)
2024/JUL /Q1
Click Here to See the Answer

Q2. a) Explain why it is necessary to have reverse power protection for alternators intended for operation. (6)
b) (i) Sketch a reverse power trip. (5)

(ii) Briefly explain the principle on which the operation of this power trip is based and how tripping is activated. (5)
2021/JAN/Q2 **2022/FEB/Q3** **2022/N OV/Q1** **2024/MAR/Q1** **2024/JUL /Q2**
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Q3. With reference to U.M.S. operations:
a) State with reasons the essential requirements for unattended machinery spaces. (8)
b) As ETO, describe how you would respond to the irretrievable failure of the Machinery space fire alarm system whilst the ship is on voyage. (8)
2024/JUL /Q3
Click Here to See the Answer

SECTION - II

Q4. A) Explain the potential hazards if liquid-cooled transformers are used.
b) In a 25 KVA, 3300/233 V, single phase transformer, the iron and full-load Cu. Losses are respectively 350 and 400 w. Calculate the efficiency at half-full load 0.8 power factor. (10)
2023/FEB/Q4 **2023/APR/Q6** **2023/JUL/Q4** **2023/SEP/Q5** **2023/NOV/Q5** **2024/JUL/Q4**
Click Here to See the Answer

Q5. 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 ohm. 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)
2023/FEB/Q5 **2023/JUL/Q5** **2024/FEB/Q5** **2024/JUL/Q5**

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Q6. 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/FEB/Q6 **2023/JUL/Q6** **2024/FEB/Q6** **2024/JUL/Q6**
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SECTION – III

Q7. With reference to an emergency fire pump state
a) The regulations that influence its location, capacity, and power. (7)
b) How the power supply to emergency pump is ensured? (5)
c) Why a relief valve is necessary on the deck main? (4)
2024/JUL/Q7
Click Here to See the Answer

Q8. a) Sketch and describe a total flooding CO2 gas system suitable for the protection of machinery spaces. (8)
b) State, with reasons, which valve should be operated first in the system shown in (a). (8)
2023/JUN/Q8 **2024/JUL/Q8**
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Q9. State how safety is achieved with regard to gas emission in battery rooms where a large number of lead-acid cells are stored with reference to
a) Provision of lighting (4)
b) Ventilation if a fan is fitted (4)
c) Type of distilled water container for topping up (4)
d) Use of tools and replacement of defective batteries (4)
2024/JUL /Q9
Click Here to See the Answer

AUG-2024
SECTION – I

Q1. 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 measurements (8).
2021/SEP/Q1 **2023/JAN/Q1** **2024/AUG/Q1**
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Q2. a) Describe the circuit breaker for an A.C. generator using a sketch to show how arcing is controlled.
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/Q1 **2024/AUG/Q2**
Click Here to See the Answer

Q3. a) Explain how the efficiency and regulation of a transformer can be assessed by open circuit and short circuit tests? (12)
b) What is meant by equivalent resistance. (4)
2024/AUG/Q3

Click Here to See the Answer

SECTION - II

Q4. a) Why is a s y nchronous motor not self -starting? What are the various ways in which it can be started? (6)
b) A coil has a resistance of 4 ohms and an inductance of 0.00954 henry. Calculate the power the coil will absorb and its power factor when it is connected to a 100-volts 50-cycle supply. (10)
2024/AUG/Q4
Click Here to See the Answer

Q5. a) Describe an accurate method of comparing the capacities of two condensers. (6)
b) A resistor of 0.525 ohms is connected to the terminals of a battery consisting of 4 cells, each e.m.f. 1.46 V joined in parallel. The circuit current is found to be 0.8 A. Find the internal resistance of each cell. (10)
2024/AUG/Q5
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Q6. a) How does change to frequency affect the operation of the transformer? What makes this ratio different from the ratio of transformer. (6)
b) The coils A and B are connected in series to 50 Hz mains. The current is 1 A and the voltage across each coil is measured to be 45 V and 70 V respectively. When the coils are connected in a d.c. supply, the current is also 1 A, but the voltages across the coils are now 20 V and 40 V respectively. Find the impedance, reactance and resistance of each coil, the total circuit impedance, the applied a.c. voltage and the power factor of the complete circuit. (10)
2024/AUG/Q6
Click Here to See the Answer

SECTION - III

Q7. With reference to “emergency preparedness”, discuss. (16)
i) Search and rescue
ii) Evacuation of critically injured personnel

iii) Helicopter operation
iv) Rescue from enclosed spaces
2024/AUG/Q7
Click Here to See the Answer

Q8. 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)
2024/AUG/Q8
Click Here to See the Answer

Q9. a) Briefly describe the environmental impact of Nox and Sox and allowable limitations as per Annex VI of MARPOL in emissions control areas and outside emission control areas.
b) Briefly describe methods to control Nox emission. (8)
2024/AUG/Q9
Click Here to See the Answer

SEP-2024

Q1. Explain the principle of operation of synchronous Motors with a simple sketch. Where are synchronous motor used onboard? (16)
2020/MAR/Q1 **2021/FEB/Q1** **2021/JUL2/Q1** **2024/SEP/Q1**
Click Here to See the Answer

Q2.a) Explain three methods of overcurrent protection for electrical circuit.
b) Explain with aid of diagram, the meaning of the term inverse current time characteristic (8)
2020/MAR/Q2 **2020/OCT/Q2** **2020/DEC/Q2**
2021/FEB/Q3 **2021/APR2/Q3** **2021/JUL/Q2** **2021/APR1/Q2**
2021/JUL2/Q2 **2021/OCT/Q3** **2021/DEC/Q2** **2022/JAN/Q3**
2022/JUN/Q2 **2024/SEP/Q2**

Click Here to See the Answer

Q3. With reference to batteries onboard:
a) Distinguish between 'Lead acid cell' and 'Alkaline cell' (6)
b) Describe how a battery of alkaline cells may be tested for its usefulness, after a long storage and if found deficient, how it can be remedied? (6)
c) Explain how the ambient temperature is taken into account when determining the condition of the battery (4)
2020/MAR/Q3 **2020/OCT/Q3** **2022/JUL/Q2** **2024/SEP/Q3**
Click Here to See the Answer

SECTION - II

Q4. With reference to a three-phase shipboard electrical distribution system:
a) Enumerate the advantages of an insulted neutral system. (4)
b) Enumerate the disadvantages of an insulted neutral system. (4)
c) Describe how the Earthed neutral system is earthed. (4)
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)
2020/MAR/Q4 **2021/OCT/Q2** **2024/SEP/Q4**
Click Here to See the Answer

Q5. a) Which has the greater equivalent resistance; two equal capacitors in series or in parallel? Explain with reasons? (6)
b) A circuit has a resistance of 3Ω inductance of 0.01H. The voltage across its end is 60V and the frequency is 50Hz. Calculate
a) the impedance
b) the power factor
c) the power absorbed. (10)
2020/MAR/Q5 **2020/DEC/Q5** **2021/MAR/Q5** **2021/OCT/Q5**
2021/NOV/Q5 **2022/APR/Q5** **2022/JUN/Q4** **2024/SEP/Q5**
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 (6)
(b) A 100 KVA, 2400/240 V, 50 Hz, 1-phase transformer has no- load current of 0.64 A and a core loss of 700 W, when its high voltage side is energized at rated voltage and frequency. calculate the two components of no-load current. If this transformer supplies a load current of 40 amp at 0.8 lagging power factor at its low voltage side, determine the primary current and its power factor. Ignore leakage impedance drop. (10)
2024/SEP/Q6
Click Here to See the Answer

SECTION - III

Q7. A. Discuss the rights and expectations of seafarers in relation to occupational safety as per maritime labour conventions. (8)
B. What are the steps taken to reduce discrimination among seafarers due to differences in age, gender, language, nationality, and culture. (8)
2024/SEP/Q7
Click Here to See the Answer

Q8. With reference to a lifeboat gravity davit arrangement:
A. Sketch the arrangement showing the lifeboat both in the housed position and at its maximum point of outboard travel. (8)
B. Describe the lowering and raising of life boat stating the safety features and the requirement as per SOLAS 74, with respect to time for hoisting. (8)
2024/SEP/Q8
Click Here to See the Answer

Q9. a) Explain the factors that are considered in the development of critical equipment and systems onboard ship as per ISM code. (8)
b) Give your opinion on the importance of identifying critical equipment and systems onboard ship. (8)
2024/SEP/Q9
Click Here to See the Answer

OCT-2024

Q1. Differentiate between half 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. (16)
2024/OCT/Q1
Click Here to See the Answer

Q2. a) i. Describe the characteristics of a D.C. motor. (4)
ii Explain the advantages of such a motor for deck machinery. (4)
b) Describe with the aid of a sketch a control system for the motor in (A). (8)
2024/OCT/Q2
Click Here to See the Answer

Q3. With reference to preferential tripping in a marine electrical distribution system.
a) With the aid of a sketch, describe a typical arrangement to provide three stages of tripping an instantaneous protection against short circuit. (10)
b) State why this protection is required. (6)
2024/FEB/Q3 **2024/OCT/Q3**
Click Here to See the Answer

SECTION – II

Q4. A) Explain the potential hazards if liquid-cooled transformers are used.
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 w. Calculate the efficiency at half-full load 0.8 power factor. (10)
2023/FEB/Q4 **2023/APR/Q6** **2023/JUL/Q4** **2023/SEP/Q5**
2023/NOV/Q5 **2024/JUL/Q4** **2024/OCT/Q4**
Click Here to See the Answer

Q5. 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 ohm. 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)
2023/FEB/Q5 **2023/JUL/Q5** **2024/FEB/Q5** **2024/JUL/Q5** **2024/OCT/Q5**
Click Here to See the Answer

Q6. 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/FEB/Q6 **2023/JUL/Q6** **2024/FEB/Q6** **2024/JUL/Q6** **2024/OCT/Q6**
Click Here to See the Answer

SECTION - III

Q7. 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/Q7 **2024/OCT/Q7**
Click Here to See the Answer

Q8. Fire protection for the accommodation spaces of passenger vessels incorporates means of detection, fighting and containment to reduce the spread of any fire.
A. Describe the means of detection and firefighting commonly installed. (8)
B. State how the spread of fire is prevented and how the containment is used with the firefighting and detection arrangement to locate the fire. (8)
2024/OCT/Q8
Click Here to See the Answer

Q9. With reference to Maritime Labour Convention (MLC) 2006, briefly discuss the following:
a) Minimum requirements for seafarers working on a ship.
b) Conditions of employment.
c) Accommodation and recreational facilities
d) Health protection, welfare, and social security protection. (16)
2024/OCT/Q9
Click Here to See the Answer

NOV-2024
SECTION - I

Q1. 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. 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 measurements. (16)
2021/SEP/Q1 **2023/JAN/Q1** **2024/AUG/Q1** **2024/N OV/Q1**
Click Here to See the Answer

Q2. What are the condition for producing sustained oscillations? Classify oscillations with respect to frequency range, principle involved, etc. It is possible to produce oscillations with RC networks in phase shift oscillator. Discuss in detail. (16) Under what conditions can you produce sustained oscillations? Classify oscillations with respect ton frequency range, principle involved, etc. It is possible to produce oscillations with RC networks in phase shift oscillator. Discuss in detail. (16)

2023/JAN/Q2 **2023/APR/Q1** **2024/JAN/Q2** **2024/NOV/Q2**

Click Here to See the Answer

Q3. Which of the following devices will prevent a DC generator from becoming motorized?

a) Over current relay

b) Motorization trip

c) Reverse power relay

d) Reverse current relay.

(a) Which of the following devices will prevent a DC generator from becoming motorized?

(i) Over current relay. (4)

(ii) Motorization trip. (4)

(iii) Reverse power relay (4)

(iv) Reverse current relay. (4)

(b) Give a detailed explanations as to why the remaining options were not considered. The reverse current relay will prevent the DC generator from motoring

2023/JAN/Q3 **2024/MAR/Q3** **2024/N OV/Q3**

Click Here to See the Answer

SECTION - II

Q4. a) What design factor limits the maximum torque of a d.c. motor? (6)

(b) A shunt motor runs on no load at 700 r/min off a 440 V supply. The resistance of the shunt circuit is 240Ω. The following table gives the relationship between the flux and the shunt current:
Shunt current (A): 0.5 0.75 1.0 1.25 1.5 1.75 2.0
Flux per pole (mWb): 6.0 8.0 9.4 10.2 10.8 11.2 11.5
Calculate the additional resistance required in the shunt circuit to raise the no-load speed to 1000r/min
2023/JAN /Q4 **2024/N OV/Q4**
Click Here to See the Answer

Q5. (a) On what factors does the capacitance of a parallel -plate capacitor depend? (6)
(b) A tuned circuit consisting of a coil having an inductance of 200μH and a resistance of 20Ω 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: (10)
(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
2023/JAN/Q5 **2024/N OV/Q5**
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 (6)
(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 (10)
2023/JAN/Q6 **2024/N OV/Q6**
Click Here to See the Answer

SECTION - III

Q7. If a small amount of oil is spilled during bunkering and causes a sheen upon the water, state what should be the procedure adopted for pollution control, information to authorities and subsequent bunkering practice (16)
2023/JAN /Q7 **2024/N OV/Q7**
Click Here to See the Answer

Q8. (a) Make a detailed sketch of a non-portable 136-liter foam fire extinguisher. (4)
(b) Briefly explain how to operate the foam extinguisher. (3)
(c) State the two constituents used, which enable stable foam to be produced.
(d) State for what approximate length of time, the extinguisher should generate foam. (3)
(e) Where on board ship would you expect such an extinguisher to be located? (3)
2023/JAN /Q8 **2024/N OV/Q8**
Click Here to See the Answer

Q9. with reference to the 1978 SOLAS protocol which outlines mandatory requirements for steering gear tests and drills:
(a) Describe the test procedure to be carried out within the 12 hours before departure on a sea voyage.
(b) Describe the emergency steering drills that must take place at least every 3 months. (5)
(c) State how often the tests in (a) and the drill in (b) should be carried out for ships which regularly engaged on voyages of short duration (5)
2023/JAN /Q9 **2024/N OV/Q9**
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DEC-2024

Q1. What is Zener diode and how does it regulate the voltage? What happens to the series current, load current and Zener current when the d.c input voltage of a Zener regulator increases? Draw a neat diagram of Zener regulator and explain. (16)
2020/FEB/Q1 **2021/JAN/Q1** **2021/JUL2/Q3** **2022/JUL/Q3** **2024/DEC/Q1**
Click Here to See the Answer

Q2. a) Briefly explain the principle of Operation of induction Motors (4)
b) What is slip for an induction motor? (4)
c) Draw a simple ladder logic diagram of star delta starting of an induction motor. (8)
2021/APR1/Q2 **2022/JUL/Q1** **2024/DEC/Q2**
Click Here to See the Answer

Q3. With respect to Insulated and Earthed Neutral Systems used on board:
a) Discuss the Advantages and Disadvantages of both Insulated and Earthed Systems used on board.
b) What is earth fault and how do you identify Earth fault in the 440 V system onboard. (4)
c) Discuss the consequences of earth fault in an earthed distribution system.
2020/DEC/Q1 **2021/JUL/Q1** **2022/JUL/Q4** **2024/DEC/Q3**
Click Here to See the Answer

SECTION - II

Q4. With the aid of suitable line diagrams, sketch and describe a suitable (MGPS) Marine growth protection system installed on vessels to prevent fouling of internal sea water system mention theimportant precautions, if any while handling the system. (16)
2024/DEC/Q4
Click Here to See the Answer

Q5. a) Which has the greater equivalent resistance; two equal capacitors in series or in parallel? Explain with reasons? (6)
b) A circuit has a resistance of 3Ω and an inductance of 0.01H. The voltage across its end is 60V and the frequency is 50Hz. Calculate
a) the impedance
b) the power factor
c) the power absorbed. (10)
2020/MAR/Q5 **2020/DEC/Q5** **2021/MAR/Q5** **2021/OCT/Q5** **2021/NOV/Q5** **2022/APR/Q5** **2022/JUN/Q4** **2024/SEP/Q5** **2024/DEC/Q5**
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Q6. Two 220 V d.c. generators each having linear external characteristics, operated in parallel. One machine has a terminal voltage of 270 V on no load and 220V at a load current of 35 A, while the other has a voltage of 280 V at no load and 220V 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. (16)
2021/NOV/Q6 **2024/DEC/Q6**
Click Here to See the Answer

SECTION - III

Q7. (a) As per Annex II of MARPOL. Describe categories in which substances are divided. (8)
(b) Give conditions under which they can be discharged outside special areas?
2023/FEB/Q7 **2024/DEC/Q7**
Click Here to See the Answer

Q8. With reference to "ISM code" write short notes on. (16)
a) Management Review
b) Advantage of drills and procedure
c) Master overriding authority.
d) Advantage of internal audit.
2023/FEB/Q8 **2024/DEC /Q8**

Click Here to See the Answer

Q9. a) Sketch and describe a total flooding CO2 gas system suitable for the protection of machinery spaces. (6)
b) State, with reasons, which valve should be operated first in the system shown in (a) (4)
c) State the periodic maintenance required on the system. (6)
2023/FEB/Q9 **2024/DEC/Q9**
Click Here to See the Answer