SEP 2025

Q1 (16 marks)

(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)

AC Motor

Q2 (16 marks)

(a) With reference to a three phase shipboard electrical distribution system:

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; (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)

Electrical distribution

Q3 (16 marks)

(a) Describe the principle of operation of EACH of the following detecting elements: (8)

(i) Bi-metal strips

(ii) Thermisters

(b) Explain, with the aid of sketches, typical applications where the devices described in (a) may be employed in high voltage electrical systems. (8)

Electrical circuits & components

Q4 (16 marks)

(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)

AC Motor

Q5 (16 marks)

(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)

Generator & circuit protection

Q6 (16 marks)

(a) Explain the principle of conservation of charge and its relationship to Kirchoff's laws. (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)

Calculations

Q7 (16 marks)

The loads of a 4-wire, 3-phase system are: (16)

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.

Calculations

Q8 (16 marks)

(a) Describe the effect of running an induction motor on reduced voltage. (6)

(b) A motor takes a current of 60 amperes at 230 volts, the power input being 12kW. Calculate the power component and the reactive component of the input current. (10)

AC Motor

Calculations

Q9 (16 marks)

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

(b) The armature resistance of a 200V-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 and when it is taking an armature current of 50A, the motor speed is 1200 rev/min. Find the approximate no load speed. (10)

Calculations

Apr 2025 - 1

May 2024 - 2