Total No. of Questions : 12] **[Total No. of Printed Pages : 5**

[3661]-14

F. E. Examination - 2009

BASIC ELECTRICAL ENGINEERING

(2003 Course)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

*(1) Answers to the **two sections** should be written in **separate answer-books**.*

(2) Black figures to the right indicate full marks.

(3) Neat diagrams must be drawn wherever necessary.

(4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.

(5) Assume suitable data, if any.

SECTION - I

Q.1) (A) Explain the effect of temperature on conducting and insulating material with graph. **[06]**

(B) Compare Lead Acid Cell and Nickel Cadmium Cell. **[06]**

(C) An electric kettle containing 0.75 liters of water raises the temperature from 30°C to 100°C using 0.5kW of power from a 240V D.C. supply. If overall efficiency of the kettle is 80%, estimate the time required for operation. Assume specific heat of water = 4200 J/kg.°k. **[06]**

OR

Q.2) (A) What is Insulation Resistance ? Derive the expression for insulation resistance of a cable. **[06]**

(B) Determine the current flowing at the instant of switching a 100 watt lamp on 230V supply. The ambient temperature is 25°C. The filament temperature is 2000°C and the resistance temperature coefficient is 0.005/°C at 0°C. **[06]**

(C) What are the factors governing the Value of Resistance ? Explain the term Resistivity. **[06]**

Q.3) (A) State the Kirchoff's Voltage and Current Law. Find the current flowing through 2Ω resistance using KVL for the circuit given in Fig.1. **[08]**

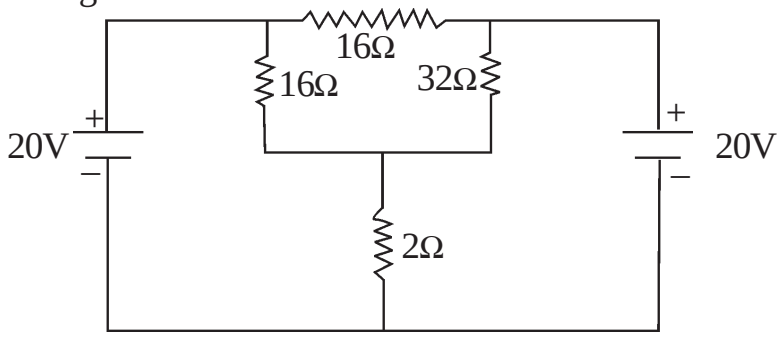


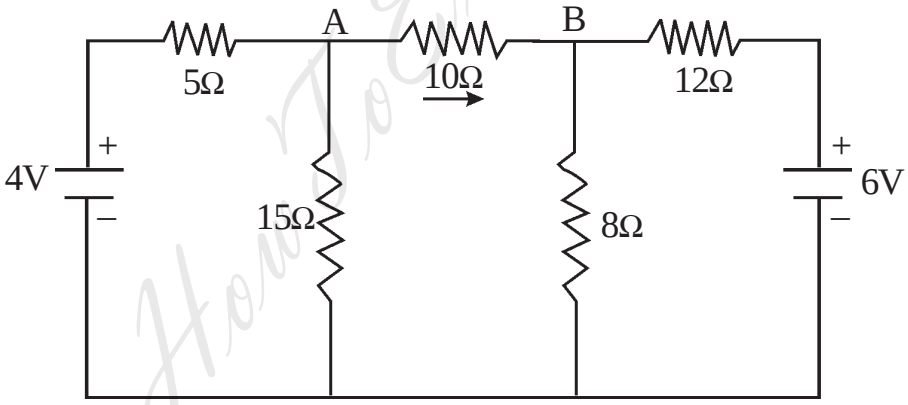
Fig. 1

(B) State and explain the Thevenin's Theorem. Also give the steps for solving a network with Thevenin's Theorem. **[08]**

OR

Q.4) (A) Derive the equations for converting a delta connected network into its equivalent star network. **[08]**

(B) Find by using Superposition Theorem, the current flowing through branch AB. **[08]**



Q.5) (A) An iron ring of 100cm mean diameter and 10cm^2 cross section has 1000 turns of copper wire on it. If the permeability of the material is 1500 and it is required to produce a flux density of 1Wb/m^2 in an air gap of 2mm wide in the ring, find

(1) Reluctance of Ring

(2) Flux Required

(3) m.m.f. Required and

(4) Current Produced **[08]**

(B) Define the following terms with its unit : **[08]**

(1) Flux Density

(2) M.M.F.

(3) Magnetic Field Strength

(4) Reluctance

OR

Q.6) (A) Explain the term Statically Induced e.m.f. and Dynamically Induced e.m.f. **[08]**

(B) Calculate the inductance of ring shaped coil having a mean diameter of 200mm wound on a wooden core of diameter 20mm of relative permeability 1. The winding is evenly wound and contains 500 turns. If the wooden core is replaced by an iron core which has relative permeability of 600 when the current is 5A, calculate new value of inductance. **[08]**

SECTION - II

Q.7) (A) Define the following term and indicate it on a sine waveform :

(1) Frequency

(2) Instantaneous Value

(3) Amplitude **[06]**

(B) Three capacitors of values 2μF, 4μF and 6μF are connected in series across a 60V supply. Determine :

(1) Equivalent Capacitance

(2) Charge on Capacitor

(3) Voltage across each Capacitor **[06]**

(C) Derive the expression for instantaneous voltage, charge and charging current for a R-C circuit. **[06]**

OR

Q.8) (A) Define the following terms with its unit : **[06]**

(1) Electric Field Strength

(2) Absolute Permittivity

(3) Electric Flux

(B) Two current $I_1 = 10 \angle 50^o$ and $I_2 = 5 \angle -100^o$ flow in single phase A.C. circuit. Estimate : **[06]**

(1) $I_1 + I_2$

(2) $I_1 \quad I_2$

(c) I_1/I_2

(C) Derive the expression for R.M.S. value of a sinusoidal varying current in terms of its peak value. **[06]**

Q.9) (A) A resistance of 20Ω, inductance of 0.05H and a capacitor of 50μF are connected in series. A supply voltage 230V, 50Hz is connected across the series combination. Calculate the following : **[08]**

(1) An impedance

(2) Current Drawn by the Circuit

(3) Phase Difference and Power Factor

(4) Active and Reactive Power Consumed by Circuit

(B) Derive the condition for series resonance in R-L-C Circuit. Also draw the frequency response of impedance, current and power factor. **[08]**

OR

Q.10) (A) Two impedances $Z_1 = 30 \angle 45^o$ and $Z_2 = 45 \angle 30^o$ are connected in parallel across a single phase 230V, 50Hz supply. Calculate : **[08]**

(1) Current Drawn by each branch

(2) Total Current

(3) Overall Power Factor

Also draw the phasor diagram indicating current drawn by each branch and total current taking supply voltage as reference.

(B) Derive an expression for the instantaneious current in a R-L series circuit when sinusoidal voltage given by $v = Vm \sin \omega t$ is applied to the circuit. Also derive the equation for average active power consumed by circuit. **[08]**

Q.11) (A) Derive the relationship between Line Current and Phase Current, Line Voltage and Phase Voltage for a balanced star connected network connected across three phase supply. Also derive the power expression for power consumed. **[08]**

(B) The iron loss of 80kVA 1000V/250V, single phase 50Hz transformer is 500W. The copper loss when the primary caries current of 50A is 400W.

Find :

(1) Area of cross section of limb if working flux density is 1T and there are 1000 turns on primary.

(2) Efficiency at full load and p.f. 0.8 lag

(3) Efficiency at 75% of full load and unity p.f. **[08]**

OR

Q.12) (A) Three identical coils each having resistance of 15Ω and inductance of 0.03H are connected in delta across a three phase 400V, 50Hz supply :

Calculate :

(a) Line and Phase Voltage

(b) Line and Phase Current

(c) Power Factor and Power Factor Angle

(d) Active and Reactive Power Consumed **[08]**

(B) Write a short note on Autotransformer. **[08]**
