[3661]-103

F. E. (Semester - I) Examination - 2009
BASIC ELECTRICAL ENGINEERING
(June 2008 Pattern)

Time : 3 Hours]   [Max. Marks : 100

SECTION - I

Q.1) (A) Define resistance temperature coefficient of a conducting material and state its unit. Discuss the effect of temperature on resistance temperature coefficient.   **[06]**

(B) A copper coil when connected to a 40 Volt supply, initially takes current of 4 Amp and has a mean temperature of 20°C. After sometime, the current flowing in the coil fall to 3.90 Amp, supply voltage remain same. The mean temperature of coil is then 34°C. Determine the temperature coefficient of resistance of 0°C and 20°C.   **[06]**

(C) Distinguish between Primary and Secondary Cells. What are the indications which confirm that a lead acidic cell is fully charged ?   **[06]**

OR

Q.2) (A) A single core insulated cable of length L m has its conductor diameter d m and the thickness of insulation surrounding the conductor is t m. Derive the expression for its insulation resistance, if the resistivity of the insulating material is ρ ohm - m.   **[06]**

(B) A bucket contains 20 liters of water at 20°C. A 2.5 KW immersion heater is used to raise the temperature of water to 95°C. The overall efficiency of process is 90% and the specific heat capacity of water is 4200 J/KG°K. Find the time require for the process. Also find cost of energy (electricity bill) for 365 days if rate of energy is Rs. 3 per unit.   **[06]**

(C)   If four cells, each rated for 2V, 0.15A can be connected as a batteries in three different ways. Find voltage and current rating of each type.   [06]

Q.3)   (A)   Explain the following terms with reference to d.c. resistive networks :   [06]

       (1)   Unilateral and Bilateral Networks

       (2)   Linear and Non-linear Networks

       (3)   Active and Passive Networks

       (B)   Using Thevenin's Theorem find the current flowing through 8 ohm resistance for the network shown in fig. 1 :   [10]
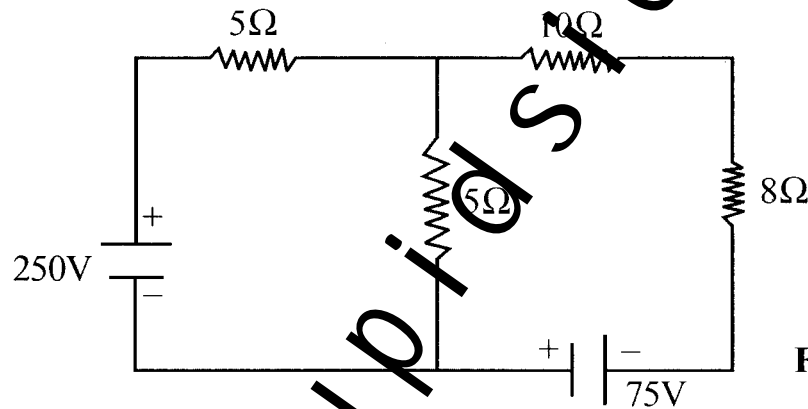

Fig. 1

OR

Q.4)   (A)   Define Star and Delta Network, hence derive an expression to convert star connected network into its equivalent delta network. [08]

       (B)   Using Superposition Theorem find the current flowing through 4 Ohm resistance for the network shown in fig. 2.   [08]
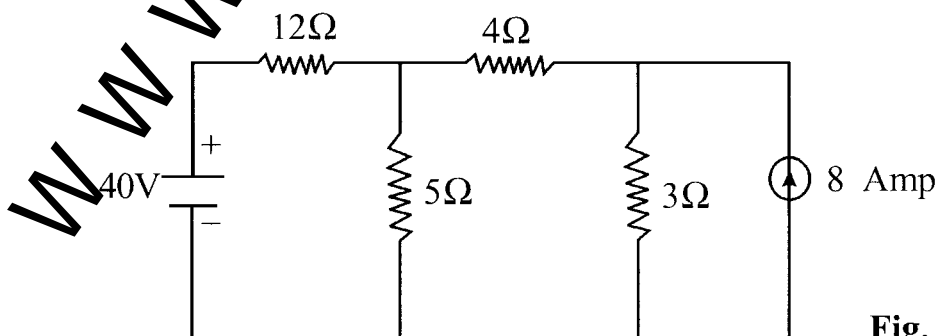

Fig. 2

Q.5) (A) Compare electric and magnetic circuits stating clearly similarities and dissimilarities between them. **[08]**

(B) An iron ring has its mean length of flux path as 60 cm and has a circular cross-section of 6.5 cm diameter. Air gap of 2mm is cut in it. A coil of 650 turns is uniformly wound around it and a current of 2.5A passes through it. Calculate the flux produced in the air gap and in the iron ring, if the relative permeability of iron is 1050. Ignore Leakage and Fringing. **[08]**

OR

Q.6) (A) State the factor upon which inductance of a coil depends. Also obtain an expression for the energy stored in a magnetic field in terms of self-inductance and current. **[08]**

(B) The Coils A and B in a Magnetic Circuit have 700 and 600 turns respectively. A current of 10A in coil A produces a flux of .04 Wb. If the Co-efficient of Coupling is 0.2.

Calculate :

(1) Self-inductance of the Coil A when B is open circuit.

(2) Flux Linkage with the Coil B.

(3) Mutual Inductance

(4) E.m.f. induced in the Coil B when the flux linking with it changes from zero to full value in 0.02s. **[08]**

SECTION - II

Q.7) (A) Derive an expression for the capacitance of a parallel plate capacitor with a composit dielectric. **[06]**

(B) Define the following terms related to sinusoidal waveform : **[04]**

(1) Form Factor

(2) Crest Factor

(C)   A circuit consist of three parallel branches. The branch currents are given as

$i_1 = 10 \sin\omega t$, $i_2 = 20 \sin(\omega t + 60)$ and $i_3 = 7.5 \sin(\omega t - 30)$.

Find the resultant current and express it in the form $i = I_m \sin(\omega t \pm \phi)$. If the supply frequency is 50 Hz calculate the resultant current when

(1) t = 0 sec. and

(2) t = 0.001 sec.   [06]

OR

Q.8) (A)   A $12\mu F$ capacitor in series with an 12 MΩ resistor is connected across a 100 volt d.c. supply. Determine

(1) The time constant of the circuit.

(2) The initial value of charging current.

(3) The initial rate of rise of voltage across the capacitor.

(4) The voltage across the capacitor 4 sec. after switch on. [06]

(B)   What do you understand by dielectric strength and breakdown voltage of a capacitor?   [04]

(C)   An alternating current of Frequency 60Hz has maximum value of 110 A. Calculate

(1) Its value $^1/_{600}$ sec. after the instant current is zero and its value decreasing thereafter.

(2) Time required to reach 90A after the instant current is zero and increasing positively.   [06]

Q.9) (A)   A sinusoidal voltage of $v = V_m \sin \omega t$ is appalled across a single phase series circuit and current flowing through the circuit is $i = I_m \sin(\omega t - \phi)$. Derive an expression for average power consumed by the circuit. Also sketch the wareform of voltage, current and power.   [08]

(B)   A circuit consist of a pure inductor, a pure resistor and a capacitor connected in series. When the circuit is supplied with 100 volt, 50 Hz supply, the voltage across inductor and resistor are 240 volt and 90 volt respectively. If the circuit takes 10A leading current calculate :

(1)   Values of inductance, resistance and capacitance

(2)   Power Factor of Circuit

(3)   Voltage Across Capacitor   [08]

OR

Q.10) (A)   Define the terms Admittance, Conductance and Susceptance as applied to a.c. circuit.   [03]

(B)   Obtain the expression for resonant frequency is series R-L-C circuit.   [04]

(C)   A coil having resistance and inductance of 15Ω and 8 mH respectively is connected in parallel with another coil having resistance and inductance of 4Ω and 18 mH. If this parallel combination is to be replaced by a single coil, calculate value of resistance, inductance of that coil. What value of capacitance should be connected in parallel with this coil in order to get unity power factor. Assume operating frequency to be 50Hz. [09]

Q.11) (A)   Explain the following terms with reference to polyphase system

(1)   Balanced Load

(2)   Phase Sequence   [04]

(B)   A single phase 90 kVA, 3.2 kV/220V, 50Hz transformer has 89% efficiency at unity power factor both at full load and half load. Determine the efficiency at 70% of full load and 0.8 power factor leading.   [06]

(C)   What is an Autotransformer ? State its merits and demerits over a two winding transformer.   [04]

(D)   Prove that power taken by three phase balanced delta connected load is three times to the power taken by same three phase balanced star connected load.   [04]

OR

Q.12) (A) Derive the e.m.f. equation of Single Phase Transformer. **[04]**

(B) Three similar coils take a power of 3KW at 0.6 power factor when connected in star to a 3pH, 415 volt, 50Hz supply. Calculate :

(1) Line Current

(2) Resistance and Inductance of each Coil **[06]**

(C) With neat circuit diagram explain the direct loading test on single phase transformer for finding the voltage regulation and efficiency. **[08]**

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