[4061] – 104

F.E. (Semester – I) Examination, 2011
BASIC ELECTRICAL ENGINEERING
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions *:* *1) In Section – **I**, attempt Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6**. In Section – **II**, attempt Q. **7** or Q. **8**, Q. **9** or Q. **10**, Q. **11** or Q. **12**.*
*2) Answers to the **two** Sections should be written in **separate** answer books.*
*3) Figures to the **right** indicate **full** marks.*
*4) Neat diagrams must be drawn **wherever** necessary.*
*5) Use of non-programmable electronic calculator is **allowed**.*
*6) Assume suitable data, if **necessary**.*

SECTION – I

1. a) With usual notations prove that **6**

$$(\alpha_1 - \alpha_2) = \alpha_1 \alpha_2 \, (t_2 - t_1)$$

b) Two coils connected in series have resistances of $600\,\Omega$ and $300\,\Omega$ and temp. coefficient of resistance of 0.1% and 0.4% respectively at 20° C. Find the resistance of combination at a temperature of 50° C. What is the effective temperature coefficient of combination ? **6**

c) What are the indications which confirm that a lead acid cell is fully charged ? **6**

OR

2. a) Define insulation resistance and obtain an expression for insulation resistance of a single core cable. **6**

b) A diesel-electric generating set supplies an output of 50 kW. The calorific value of fuel used is 12,500 k cal/kg. If the overall efficiency of the unit is 35%. (i) Calculate the mass of oil required per hour and (ii) The electrical energy generated per tonne of the fuel. **6**

c) Compare lead acid cell and Nickel cadmium cell. **6**

3. a) Explain the following terms with reference to dc resistive networks :
   1) Unilateral and bilateral networks
   2) Linear and non linear networks
   3) Lumped and distributed networks
   4) Active and passive networks. **8**

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b) Formulate the Kirchhoff's voltage law equations for the ckt of Fig. 1 and find the values of I_1, I_2 and I_3. **8**

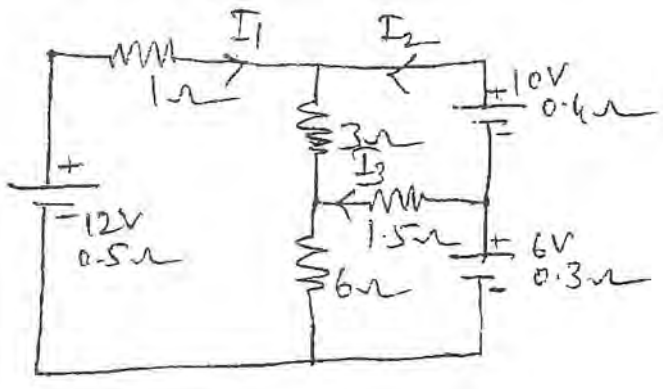

Fig. 1

OR

4. a) Derive an expression to convert Delta connected network into its equivalent star network. **8**

b) Find the current in $20\,\Omega$ resistor connected across AB using Thevenin's Theorem. **8**

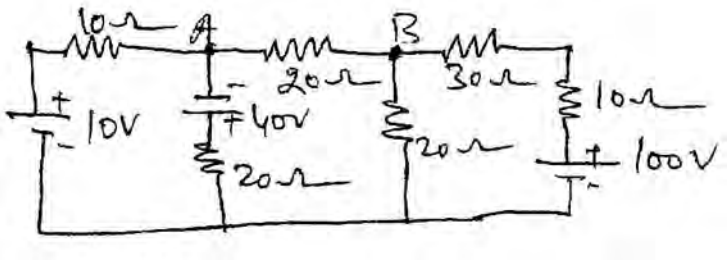

Fig. 2

5. a) Compare electric and magnetic circuits clearly stating similarities and dissimilarities between them. **8**

b) A coil of 2000 turns is wound uniformly over a nonmagnetic ring of mean circumference of 80 cm and cross sectional area of 0.6 cm^2. If the current through the coil is 2 amperes, calculate (i) Magnetising force (ii) Reluctance (iii) Total flux (iv) Flux density. **8**

OR

6. a) Derive the expression for the energy stored in the magnetic field in terms of energy stored per unit volume. **8**

   b) Two coils X and Y, X of 12000 turns and Y of 15000 turns lie in parallel planes so that 45% of the flux produced by coil X links coil Y. A current of 5A in X produces 0.05 mwb, while the same current in Y produces 0.075 mwb. Calculate (i) the mutual inductance and (ii) the coefficient of coupling. **8**

SECTION – II

7. a) Derive mathematical expression for voltage and current at any instant during charging of capacitor through resistance. Also sketch the graph of capacitor voltage and current with respect to time. **8**

   b) Two flat parallel plates measuring 1m × 2 m and separated 10 cm are charged by transferring 10^{-6} coulombs from one plate to other. The permittivity of the oil between the plates is 2. Calculate (i) capacitance of the parallel plates (ii) potential difference between the plates (iii) electric field intensity (iv) electric flux density between the plates. **8**

OR

8. a) Prove that an alternating quantity varying sinusoidally the maximum value is $\sqrt{2}$ times the effective value. Similarly maximum value is also equal to 1.569 times the average value. **8**

   b) In a parallel ckt the three branches, the instantaneous branch currents are represented by

   $i_1 = 10 \sin wt$

   $i_2 = 20 \sin (wt + \pi/3)$

   $i_3 = 12 \sin (wt - \pi/6)$

   Write down the expression for the total instantaneous current in the form

   $i = I_m \sin (wt + \phi)$. **8**

9. a) A sinusoidal voltage $V = V_m \sin wt$ is applied across a series R – L ckt. Derive the expression for current and average power consumed by the ckt. **8**

   b) A series R-L-C ckt with resistance of $50\,\Omega$, capacitance of $25\,\mu F$ and an inductance of 0.15 H is connected across 230 V, 50 Hz supply. Determine (i) impedance (ii) current (iii) power factor and (iv) power consumption of the ckt. **8**

OR

10. a) What is impedance of ac ckt ? What are its components ? State the units these quantities. How is impedance expressed in rectangular and polar form ? **6**

    b) A and B are two circuits connected in parallel across 200 V, 50 Hz supply. Ckt A consists of choke coil whose resistance is 5Ω and reactance 2Ω. Ckt B consists of non inductive resistor of 6Ω connected in series with a capacitor of capacitive reactance 8Ω calculate (i) total current (ii) power factor of combined ckt and (iii) the resistance and reactance of a series ckt which will take the same current at the same power factor as the parallel combination. Solve by admittance method. **10**

11. a) Write the advantages of 3 phase ac system over single phase ac system. **6**

    b) Define the following terms related to 3 phase ckt. **4**

    i) Symmetrical system ii) Phase sequence

    iii) Balanced load iv) Unbalanced load

    c) Three coils are connected in delta to a 3 phase, 3 wire, 415 V, 50 Hz supply and take a line current of 5A at a 0.8 power factor lagging. Calculate the resistance and inductance of the coils.

    If the coils are star connected to the same supply, calculate the line current and the total power. **8**

OR

12. a) Compare core type and shell type of transformers. **4**

    b) From first principles derive the emf equation of a single phase transformer. **4**

    c) A transformer is rated at 100 kVA at full load its copper loss is 1200 W and its iron loss is 960 W. Calculate :

    i) The efficiency at full load, unity power factor

    ii) The efficiency at half load 0.8 power factor

    iii) The efficiency at 75% full load, 0.7 power factor

    iv) The load KVA at which maximum efficiency will occur

    v) The maximum efficiency at 0.85 power factor. **10**

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