[4261] – 104

Seat No.	

F.E. (Semester – I) Examination, 2012
BASIC ELECTRICAL ENGINEERING
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Attempt Q. No. **1** or **2**, Q. No. **3** or **4**, Q. No. **5** or **6**, Q. No. **7** or **8**, Q. No. **9** or **10**, Q. No. **11** or **12**.*
*2) Answer to the **two** Sections must be written **separate** answer-books.*
*3) Figures to the **right** indicate **full** marks.*
*4) **Use** of non-programmable pocket size scientific calculator is **permitted**.*
*5) **Neat** diagrams must be drawn **wherever** necessary.*
*6) Assume **suitable** data, **if necessary**.*

SECTION – I

1. a) Define insulation resistance and obtain an expression for it of a single core cable. **8**

   b) A motor pump set lifts 70 cubic meter of water per hour to a height of 40 meters. Efficiency of motor is 87% and that of pump is 83%. Find the monthly Bill for the use of set if it is used for 4 hours a day for 30 days. Cost of Electrical Energy is Rs. 10 per unit. **8**

OR

2. a) If α_1 and α_2 are the resistance temp. coefficients at t_1°C and t_2°C respectively then prove that

   i) $\alpha_1 - \alpha_2 = \alpha_1\alpha_2 (t_2 - t_1)$ and

   ii) $\alpha_1 / \alpha_2 = 1 + \alpha_1(t_2 - t_1)$ **8**

   b) An insulated cable has conductor diameter of 3 cm and insulation thickness of 2 cm. The resistivity of copper and insulation is $1.73 \times 10^{-8}\,\Omega - m$ and $9 \times 10^{12}\,\Omega - m$ respectively. Determine the resistance of conductor and insulator of the cable for 150 m length. **8**

P.T.O.

3. a) Calculate the current flowing in the 10Ω resistance for the circuit shown in fig. 1 applying Kirchhoff's laws. **10**

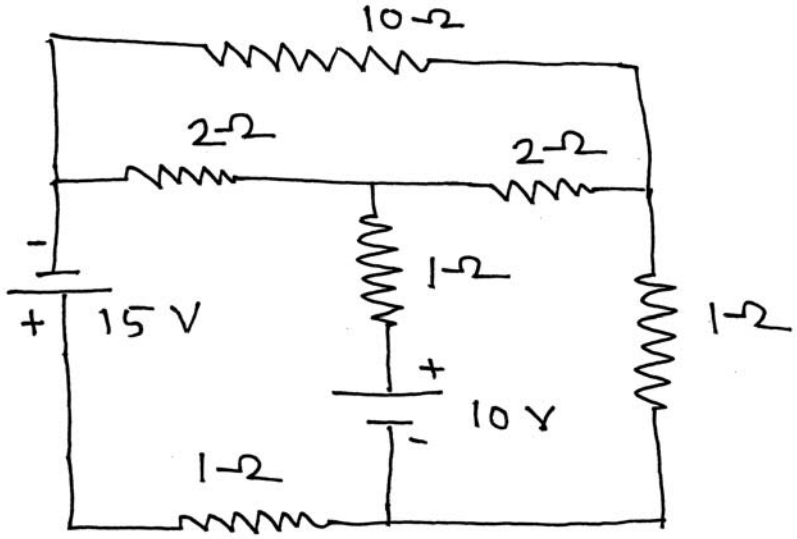

Fig. 1 Q. 3(a)

b) State and explain superposition theorem. **6**

OR

4. a) Apply Thevenin's theorem to calculate the current flowing in 10Ω resistance for the circuit shown in Fig. 1. **10**

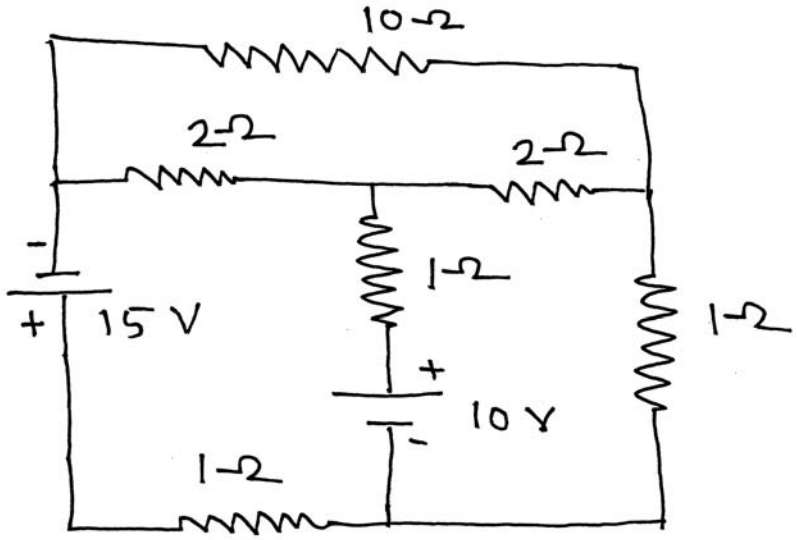

Fig. 1 Q. 4(a)

b) State and explain maximum power transfer theorem. **6**

5. a) Compare Electric and Magnetic circuit. **6**

   b) Derive an expression for energy stored in the magnetic field. **6**

   c) Calculate the inductance of a toroid, 25 cm mean length and 6.25 cm^2 circular cross section, wound with 1000 turns of wire. Also calculate the emf induced when a current increasing at the rate of 200 A/s flows in the winding. **6**

OR

6. a) Define as ref. to magnetic circuit i) Magnetic flux, ii) Magnetic flux density iii) Field strength iv) Reluctance and v) Permeance. **10**

   b) Draw a series magnetic circuit and parallel magnetic circuit also write down the expression for total Amp turns required ref. to both circuits. **8**

SECTION – II

7. a) Define R.M.S. value of sinusoidal quantity. Derive its expression in terms of peak value. **6**

   b) A potential difference of 11 KV is applied across a parallel plate capacitor with plate area of 0.01 m^2 separated by dielectric material 1 mm thick. The resulting capacitance of the arrangement is 300 pF. Calculate –

      i) Total electric charge

      ii) Electric flux density

      iii) Potential gradient

      iv) Relative permitivity of the dielectric. **5**

c) At t = 0, the instantaneous value of 60 Hz sinusoidal current is +5A and increases in magnitude further. Its rms value is 10 Amp.

i) Write the expression for its instantaneous value.

ii) Find the current at t = 0.01 sec.

iii) Sketch the waveform showing all values. **5**

OR

8. a) Define average value of sinusoidal quantity. Derive its expression in terms of peak value. **6**

b) A 12 μF capacitor is charged through 4 MΩ resistance from 120 V d.c. supply. Calculate

i) Time constant of circuit

ii) Time required for the voltage across the capacitor to reach 50 V

iii) Voltage across the capacitor 50 sec after closing the switch. **5**

c) Three alternating currents are given by

$i_1 = 150 \sin (\omega t + \pi/4)$

$i_2 = 40 \sin (\omega t + \pi/2)$

$i_3 = 80 \sin (\omega t - \pi/6)$

They are fed into a common conductor. Find the equation of resultant current. Also find rms value of resultant current. **5**

9. a) If a sinusoidal voltage $V = V_m \sin\omega t$ is applied across purely capacitive circuit, derive the expression for current drawn and power consumed. Draw the waveform of current voltage and power. **8**

b) A coil having resistance of $15\,\Omega$ and inductance of 0.05 H is connected in series with $100\,\mu F$ capacitor across 230 V, 50 Hz a.c. supply. Find :

i) The current taken

ii) The phase difference between supply voltage and current

iii) Voltage drop across the coil

iv) Voltage drop across the capacitor. **8**

OR

10. a) Sketch :

i) Impedance triangle

ii) Admittance triangle

Define admittance, susceptance and conductance as related to a.c. circuit. How admittance is expressed in rectangular form ? **8**

b) Impedance of $(4 - j10)\Omega$ is connected in parallel with another impedance of $(6 + j8)\Omega$. The circuit is connected across 230 V, 50 Hz, single phase a.c. supply. Find :

i) Branch currents

ii) Total current

iii) Total power factor of circuit

iv) Power consumed by the circuit

v) Total impedance of the circuit. **8**

11. a) Derive the expression for emf equation of single phase transformer. Hence write down the expression for transformation ratio. **6**

b) A 1.5 KVA, 220/110 V, 50 Hz single phase transformer has iron less of 32 W and full load copper less of 44 W. Calculate % efficiency of transformer at

i) Full load 0.8 p.f. log

ii) Full load unity p.f

iii) Half full load 0.8 p.f. lead. **6**

c) State the relationship between line and phase values of voltage and current for 3 phase star connected load and delta connected load state the equation of active and reactive power consumed by 3 phase load. **6**

OR

12. a) With neat diagram describe a test for finding out the efficiency and regulation of transformer by direct loading. **6**

b) Three identical coils each having resistance of 15Ω and inductance of 0.03 H are connected in delta across 3 phase, 440 V, 50 Hz supply. Calculate line current and power consumed by the load.

If the same load is now connected in star across same supply. Calculate the power consumed by the load. **6**

c) State different losses occurring in single phase transformer. Mention the part where each loss occurs. How these losses can be minimised ? **6**
