Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-II Examination June- 2010

Subject code: 110005

Subject Name: Elements of Electrical Engineering

Date:19 / 06 / 2010 **Time:02.30 pm – 05.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Find the resistance between the terminals A and B in the network shown in the **Fig. 1**. **06**

(b) A carbon colour coded resistor has first ring of orange, second of blue, third of red and fourth of golden colour. Find the specifications of the resistor. **02**

(C) Define temperature co-efficient of resistance. How does the resistance of different materials vary with temperature? **06**
Prove that $\alpha_t = \alpha_0/(1+\alpha_0 t)$ and $\alpha_2 = 1/[(1/\alpha_1) + (t_2-t_1)]$

Q.2 **(a)** (i)Give the circuit diagram of ELCB. Explain its working and applications. **04**
(ii) Discuss any one method of earthing. **03**

(b) In the RC circuit shown in the **Fig. 2**, R= 2 MΩ and C= 5μF. The capacitor is charged to an initial potential of 50 V, when the switch is closed at t=0+. Calculate **07**
1. Initial rate of charging of the capacitor voltage.
2. Capacitor voltage after time = 5λ seconds.

If the polarity of the capacitor voltage is reversed, calculate,
3. The values of the above quantities.
4. Time taken for Vc to reach -10 V, 0V and 95 V.

OR

(b) Two square conducting plates having a cross sectional area of 2500 cm^2 and 1 cm distance between them are connected across a 600 V supply voltage. They have a dielectric, 0.8 cm thick having a relative permittivity of 4 between them. The remaining space is filled with air. Calculate the capacitance of the condenser and the energy stored in it. **07**

Q.3 **(a)** Describe "Ceramic Capacitors". **03**

(b) An iron ring of 40cm mean diameter and a cross section of 3 cm diameter, has an air gap of 2 mm. It is uniformly wound with 750 turns of wire and carries a current of 3 A. The iron path takes 60 % of the total mmf. Neglect magnetic leakage. Find the total mmf, magnetic flux, reluctance and flux density in the ring. **05**

(C) Discuss the forces acting between two parallel current carrying conductors. **06**

OR

Q.3 **(a)** Compare electrical circuit with magnetic circuit. **03**

(b) Derive the equation for the co-efficient of coupling of two magnetically coupled coils A and B. **05**

(c) Two coils having 200 and 100 turns respectively are wound side by side on a closed iron circuit of cross section 140 cm^2 and mean length of flux path135 cm. The current in the first coil increases steadily from 0 to 7 A in 5 milliseconds. Assume the co-efficient of coupling equal to 1 and the permeability of iron equal to 1800. Find the self inductance of each coil and the induced emf in the second coil. **06**

Q.4 **(a)** A series RLC circuit consists of a resistance of 500 Ω, inductance of 50mH and a capacitance of 20 pF. Find **05**

1. The resonant frequency.
2. The Q-factor of the circuit at resonance.
3. The half power frequency.

(b) Discuss different methods of representation of vector quantities. **03**

(c) Calculate the RMS and average value of the sinusoidal waveform shown in the **Fig.3** From them, find the peak factor and form factor. **06**

OR

Q.4 **(a)** Discuss how the inductance of a choke coil can be measured using a rheostate, a voltmeter and an ammeter. **04**

(b) Derive the equation of power in a single phase AC circuit in vector form only. **02**

(c) In a series parallel circuit, the parallel branches 'A' and 'B' are in series with branch 'C'. The impedances are $Z_A = (4+j3)\ \Omega$, $Z_B = (4-j16/3)\ \Omega$ and $Z_C = (2+j8)\ \Omega$. If the current Ic = (25+j0) Amp., determine the branch currents and voltages and the total voltage. Hence calculate the complex power (the active and reactive powers) for each branch and the whole circuit. **08**

Q.5 **(a)** Three identical coils each of (4.2 +j5.6) Ω are connected in star across a 415 V, 3 phase, 50 Hz AC supply. Find **05**

1. Phase voltage.
2. Phase current.
3. Readings of two wattmeter's W1 and W2 when they are connected to measure the total power.

(b) Discuss staircase wiring. **03**

(c) 1. Discuss electrical characteristics of batteries. **04**

2. Give connection diagram of a battery charging circuit **02**

OR

Q.5 **(a)** A delta connected load having branch impedances of (15 +j20) Ω is connected to a 220V, 3 phase AC supply. Find **05**

1. Line currents.
2. Per phase power consumed.
3. What is the phasor sum of the line currents? Why does it have this value?

(b) Draw the connection diagram of a tube light and explain its starting and working. **04**

(c) Explain the construction of a three phase cable. **05**