Candidate seat No: _____

Charotar University of Science and Technology [CHARUSAT]
Faculty of Technology and Engineering
CSPIT/DEPSTAR

Subject: EE 145 Basics of Electronics and Electrical
First Unit Test_Solution

Semester: 1st SEM B. Tech. (EC,CSE,CE,IT) **Maximum Marks: 30**
Date: 11/09/2019 (Wednesday) **Time: 11:10 am to 12:10 pm**

Instructions:
(i) Attempt ***all*** the questions.
(ii) Figures to the right indicate ***full*** marks.
(iii) Make suitable assumptions and draw neat figures wherever if required.

Q-1 Answer the questions below. **[10]**

a. A coil of 400 turns of wire is wound on a magnetic circuit of reluctance 2000 AT/mWb. If a current of 2 A flowing in the coil is reversed in 10 ms, find the average emf induced in the coil. **[3]**

(Ans emf=32 V)

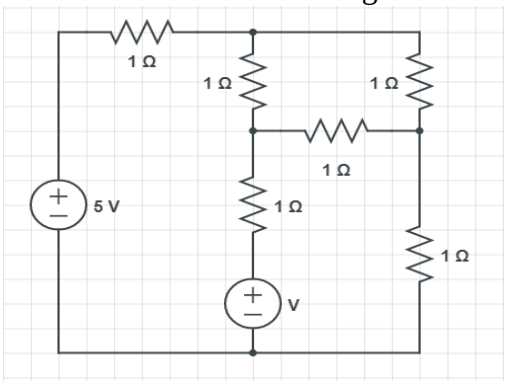
b. The resistance of the field coils of a dynamo is 200 ohms at 16ºC. After working for 6 hours on full load, the resistance of the coil increases to 250 ohms. Calculate the mean temperature rise of the field coils. Assume temperature coefficient of resistance of Copper to be 0.00426/ ºC at 0ºC. **[3]**

(Ans rise in temperature = 62.688 ºC)

c. Define (i) Magnetic flux (ii) Magneto motive force (iii) Electromagnetic Induction (iv) Resistivity. **[4]**

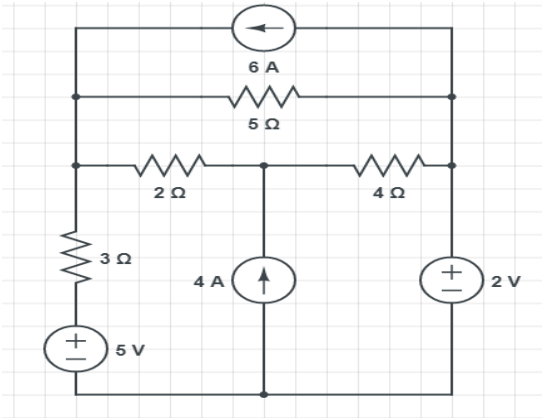
Q-2 Answer the questions below. **[10]**

a. Find V by Mesh analysis such that the current through 5V source is zero. **[5]**



Ans: V = 10v

b. Solve the circuit using Nodal analysis. **[5]**



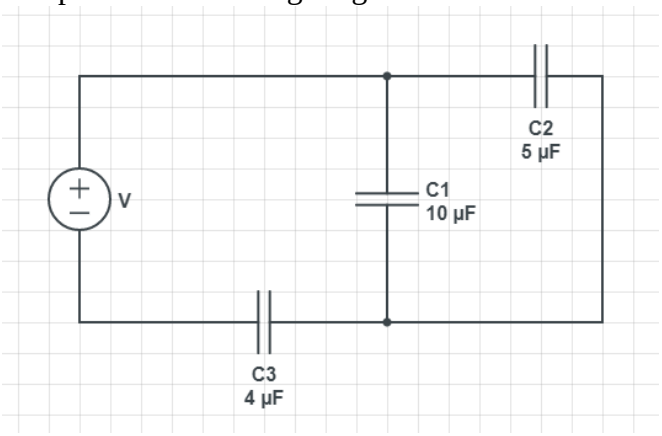
V_1= 15.6, V_2= 16.51, V_3=2V

Q-3 Answer the questions below. **[10]**

a. An air-filled parallel plate capacitor has a capacitance of 1.3 pF. The separation of the plates is doubled and wax is inserted between them. The new capacitance is 2.6pF. Find the dielectric constant of the wax. **[3]**

Ans: Dielectric constant of the Wax = 4

b. Find the equivalent capacitance in the figure given below: **[2]**



Ans: Ceq= 3.16μF

c. A parallel plate capacitor has a plate area of 50 cm^2 and a plate separation of 1 cm. A potential difference of V_0=200V is applied across the plates with no dielectric present. The battery is then disconnected, and a piece of Bakelite (K=4.8) is inserted which fills the region between the plates. What is the capacitance, the charge on the plates, and the potential difference between the plates, before and after the dielectric is inserted? **[5]**

Ans: Before the dielectric is inserted, the space between the plates is presumably filled with air. Thus,

$$C_0 = \frac{\epsilon_0 A}{d} = \frac{(8.85 \times 10^{-12})(50 \times 10^{-4})}{(1 \times 10^{-2})} = 4.4\,\mathrm{pF}.$$

After the dielectric is inserted, the capacitance increases by a factor K, which in this case is 4.8, so the new capacitance C is given by

$$C = K C_0 = (4.8)(4.4 \times 10^{-12}) = 21\,\mathrm{pF}.$$

Before the dielectric is inserted, the charge Q_0 on the plates is simply

$$Q_0 = C_0 V_0 = (4.4 \times 10^{-12})\,(200) = 8.8 \times 10^{-10}\,\mathrm{C}.$$

After the dielectric is inserted, the charge Q is exactly the same, since the capacitor is disconnected, and so the charge cannot leave the plates. Hence,

$$Q = Q_0 = 8.8 \times 10^{-10}\,\mathrm{C}.$$

The potential difference before the dielectric is inserted is given as V_0=200V. The potential difference V after the dielectric is inserted is simply

$$V = \frac{Q}{C} = \frac{(8.8 \times 10^{-10})}{(21 \times 10^{-12})} = 42\,\mathrm{V}.$$