KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

Electrical Engineering Department

EE 208 ELECTRICAL SYSTEMS

Experiment # 7 A DC CIRCUIT WITH A CAPACITOR & KIRCHHOFF'S LAW

OBJECTIVE:

1- To determine the **DC** voltages and currents in a circuit that contains a **capacitor** experimentally.

2- To **verify Kirchhoff's** voltage and current laws experimentally.

APPARATUS: DC Power Supply
Ohmmeter, DC Voltmeter and DC Ammeter
Carbon Resistors: 100 Ω, 150 Ω, 220 Ω, and 330 Ω
One Polarized Capacitor: 100 μF, 10 VDC

THEORY:

- **Kirchhoff's Voltage Law (KVL):**

  The algebraic sum of all voltages around any closed path is equal to zero.

- **Kirchhoff's current Law (KCL):**

  The algebraic sum of all currents at a junction point is equal to zero.

- **In a DC circuit a capacitor operates as an open circuit.**

$$I_C = C\frac{d\,Vc}{d\,t}$$

⇨ Thus if V_c is constant (which is for DC circuits) $\mathbf{I_c = 0}$.

⇨ And $I_c = 0$ means an **open circuit**.

PROCEDURE:

1- **Check** the values of the resistors, used in the circuit of **Figure1**, using a Ohmmeter. **Record** the values in Table 1.

2- **Connect** the circuit as shown in Figure 1, and **have it checked** by the instructor.

3- **Adjust** the supply voltage **Vs to 10 V**, using a DC voltmeter.

4- **Measure** the voltages $\mathbf{V_{AB}}$, $\mathbf{V_{BC}}$, $\mathbf{V_{AD}}$, $\mathbf{V_{DC}}$, $\mathbf{V_{BD}}$, **and** $\mathbf{V_{AC}}$. Record their values (***including the signs***) in Table 2.

5- **Measure** the currents $\mathbf{I_1}$, $\mathbf{I_2}$, $\mathbf{I_3}$, $\mathbf{I_4}$, $\mathbf{I_5}$ and $\mathbf{I_6}$ and **record** their values (**including the signs**) in Table 3.

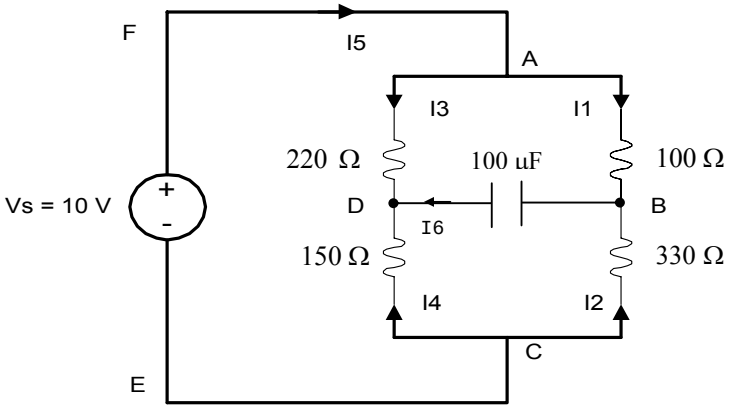

Figure 1

REPORT:

1- **Calculate** the **theoretical** values of V_{AB}, V_{BC}, V_{AD}, V_{DC}, V_{BD}, and V_{AC} shown in Figure 1 and record your result in Table 2.

2- **Calculate** the **theoretical** values of I_1, I_2, I_3, I_4, I_5 and I_6 shown in Figure 1 and record your result in Table 3.

4- **Calculate** the % difference between the **theoretical** and **experimental** values of voltages and currents and record your calculation in Table 2 and 3.

3- **Verify KVL** by adding the <u>experimental values</u> of voltages around the following loops and record the results in Table 4.

a) ABCEFA
b) ABDA
c) BDCB
d) ABCDA

4- **Verify KCL** by adding the **<u>experimental values</u>** of current at the following nodes and record the results in Table 5.

a) A
b) B
c) C
d) D

QUESTIONS:

1- Do the experimental and theoretical values of voltages and currents agree?
2- Are KVL and KCL verified experimentally?
3- Give possible reasons for any discrepancies.

EXPERIMENT # 7 Laboratory Report

Name: ..... **I.D.** ..... **Lab. Section:** .....

TABLE 1

Resistor Values:

Resistor	R_1	R_2	R_3	R_4
Nominal Value (Ω)	100	330	220	150
Ohmmeter reading				

TABLE 2

Voltages:

Voltage	V_{AB}	V_{BC}	V_{AD}	V_{DC}	V_{BD}	V_{AC}
Theoretical						
Experimental						
% Error						

TABLE 3

Currents:

Current	I_1	I_2	I_3	I_4	I_5	I_6
Theoretical						
Experimental						
% Error						

TABLE 4

KVL:

Loop	Sum of Theoretical Voltages	Sum of Experimental Voltages
ABCEFA		
ABDA		
BDCB		
ABCDA		

TABLE 5

KCL:

Node	**Sum of Theoretical Currents**	**Sum of Experimental Currents**
A		
B		
C		
D		