SEMESTER PROJECT

MOONLIGHT BEACH RESORT

WEB ENGINNERING
CIS 324

PRESENT TO

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The semester project would not have been possible without the dedication and collaboration of all those involved. I am incredibly grateful for the opportunity to have worked with such a talented and committed team.

Thank you again for your contributions to the EDC Semester project. I am proud of what we have accomplished together.

INTRODUCTION

Electronics is a fundamental branch of engineering that deals with the study of the behavior of electrons and their interactions with matter. It encompasses a wide range of topics, including circuit analysis, semiconductor devices, digital electronics, and communication systems.

Electronics plays a crucial role in modern society, powering everything from our smartphones to our cars to our medical devices. It is an essential part of our daily lives, and its impact is only going to grow in the years to come.

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Task – 01.Q1

1.1 Is covering topics sufficient during the Fall-2023 of EDC student.

Electronic devices and circuits are the foundation of modern technology. They are used in everything from our computers and smartphones to our cars and airplanes. Understanding electronic devices and circuits is essential for anyone who wants to work in the field of electronics or who wants to be able to troubleshoot and repair their own electronic devices.

Electronic devices and circuits are an important course for students during Fall-2023 to be interested in the field of electronics. It is a fundamental course that provides a strong foundation for understanding how electronic devices work and how they are used in circuits.

The course covers a wide range of topics, including:

- *Basic concepts of electricity:* voltage, current, resistance, and power
- *The behavior of electrons in materials:* conductors, semiconductors, and insulators
- *The operation of basic electronic devices:* diodes, transistors, and op-amps
- *The analysis and design of electronic circuits:* amplifiers, oscillators, and filters

Here are some of the reasons to electronic devices and circuits is an important course:

- Electronic devices and circuits are essential for anyone who wants to work in the field of electronics, and it is also an asset for anyone who is simply interested in how electronic devices work.
- It prepares students for further study in electronics. The course covers a wide range of topics that are essential for understanding more advanced electronic systems.
- Solve a variety of problems, which helps them to develop their problem-solving skills.
- The courses are also valuable for students who want to work in related fields, such as computer engineering, electrical engineering, and telecommunications.

During Fall-2023 semester course instructor of EDC are covers various topic:

- Basic components of electrical circuit
- Terminology of circuits (branch, node, loop, mesh, junction)
- Series and parallel circuit
- KCL, KVL, CDR, VDR
- Nodal analysis
- Open and short circuit
- Wye-delta conversion
- Clipper, and clamper circuit
- Inverting and non-inverting circuits

The listed of covered topic are insufficient for learning **Electronic Devices and Circuit**. It is important to note that these topics are the foundation of electronic devices and circuits, and there are many other important topics that are not covered in these lectures. EDC courses are most important to learning modern technologies such as Robotics, Embedded System, and Internet of Things (IoT).

However, there are a few additional topics that would be helpful to learn to get a comprehensive understanding of the subject. These include:

- The operation of transistors
- The analysis of AC circuits
- The design of digital circuits
- The use of electronic devices in applications such as amplifiers, oscillators, and filters

Overall, the topics covered in the lectures on electronic devices and circuits are a good starting point for students who are interested in learning about the subject. However, it is important for students to learn more advanced topics. However, it's important to note that electronic devices and circuits are a vast and intricate field. The listed topics alone may not be sufficient to provide a comprehensive understanding of the subject. Electronic devices and circuits are a broad field with many complex topics, and it would be difficult to cover everything in a single course.

Task- 1.Q2

1.2 CDR and VDR into the circuit

The voltage divider rule (VDR) and the current divider rule (CDR) are two fundamental concepts in electronics that are used to analyze and design electrical circuits. These rules are based on Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL).

Voltage Divider Rule

The voltage divider rule is used to calculate the voltage across any resistor in a series circuit. It is based on the principle that the current flowing through all the resistors in a series circuit is the same.

Formula

Properties of the Voltage Divider Rule:

- The voltage across each resistor in a series circuit is a fraction of the total input voltage.
- The voltage across a resistor is directly proportional to its resistance relative to the total resistance.
- The current flowing through all resistors in a series circuit is the same.

Current Divider Rule

The current divider rule is used to calculate the current flowing through each resistor in a parallel circuit. It is based on the principle that the voltage across all the resistors in a parallel circuit is the same.

Formula

Properties of the Current Divider Rule:

- The current flowing through each resistor in a parallel circuit is a fraction of the total current.
- The current flowing through a resistor is inversely proportional to its resistance relative to the total resistance.
- The voltage across all resistors in a parallel circuit is the same.

Mr. Tushar visualize the circuit diagram based on the scenario:

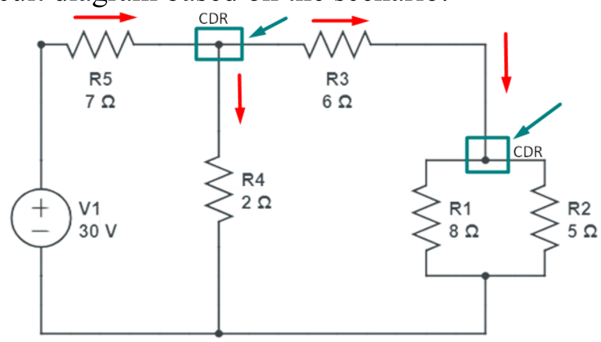


Diagram: Combine circuit

It is possible to apply Current Divider Rule (CDR) and Voltage Divider Rule (VDR) reason of this circuit the combination of serious and parallel circuit.

When need to calculate the current of combine or hybrid circuit to apply current divider rule (CDR) and calculate the voltage of combine or hybrid circuit to apply voltage divider rules (VDR). If circuit type series, get the value of voltage on the circuit. On the other hand, if circuit type parallel, get the value of the current on the circuit.

Task- 1.Q3

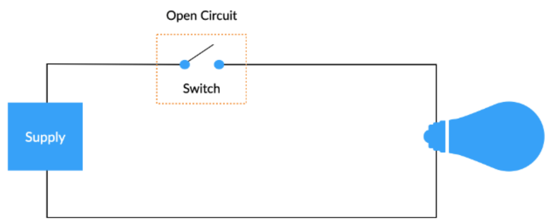
1.3 Open and Short Circuits

Open circuit

An open circuit is defined as an electric circuit in which current does not flow. This means that there is a break in the circuit, and electrons cannot travel from the source of power to the load.
If there's a break anywhere in the circuit, you have an open circuit, and current cannot flow**.** Open circuits can occur for a variety of reasons, such as a broken wire, a faulty switch, or a blown fuse.

Here are some of the characteristics of an open circuit:

- No current flows in the circuit.
- The voltage across the break in the circuit is equal to the source voltage.
- The power dissipated by the circuit is zero.



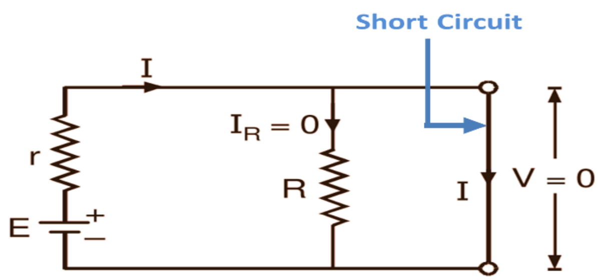
Diagram

Short circuit

A short circuit is an unwanted or unintentional path that current can take which bypasses the routes you want it to take.
A short circuit is simply a low resistance connection between the two conductors supplying electrical power to any circuit. A short is typically represented as a wire. The two terminals are externally connected with resistance R=0, the same as an ideal wire. This means there is zero voltage difference for any current value.

Causes of Short Circuits

- Damaged wires
- Loose connections
- Water damage
- Overloading



Task- 2.Q4

2.4.1 Visualize the circuit diagram

Visualize the circuit diagram based on the scenario of the semester project:

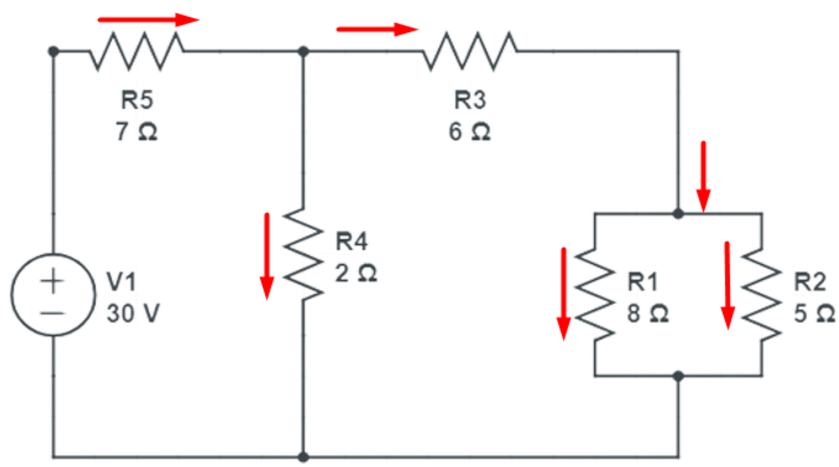


Fig: circuit diagram

Here,

$R_1 = 8\ \Omega$
$R_2 = 5\ \Omega$
$R_3 = 6\ \Omega$
$R_4 = 2\ \Omega$
$R_5 = 7\ \Omega$

Analysis the circuit and prove:

Now analysis the circuit and prove the current = 3.47 and 5 ohms' to through the 0.39A current are flowing.

R_1 and R_2 circuit are connected in parallel, their equivalent resistance can be computed using the following formula:

$$\boldsymbol{R_{eq}} = \frac{\boldsymbol{R_1\ X\ R_2}}{\boldsymbol{R_1 + R_2}}$$

$R_{12eq} = \frac{8\ X\ 5}{8+5} = \frac{40}{13} = 3.07\ \Omega$ $R_1 = 8$ and $R_2 = 5$

Since $R_{12eq} = 3.07\ (\Omega)$ and $R_3 = 6\ (\Omega)$ circuit are resistors are connected in series, their equivalent resistance can be calculated using the following formula:

$R_s = R_{12eq} + R_3 = 3.07 + 6 = 9.07\ (\Omega)$

Then R_s and R_4 circuit are connected in parallel, their equivalent resistance can be computed using the following formula:

$R_{eq2} = \frac{R_1 \, X \, R_2}{R_1 + R_2}$

$R_{eq2} = \frac{9.07 \; X \; 2}{9.07+ \; 2} = \frac{18.14}{11.07} = 1.64 \; \Omega$ (R_{eq2} = 9.07Ω and R_2 = 2 Ω)

Finally, R_{eq2} = 1.64 (Ω) and R_5 = 7 (Ω) circuit are resistors are connected in series, their equivalent resistance can be calculated using the following formula:

$R_{total} = \; R_{eq2} \; + R_5 = 1.64 + 7 = 8.64$ (Ω)

Now calculate the current of the circuits using the following formula (Ohm's Law):

$\boldsymbol{V = IR}$

$\boldsymbol{I} = \frac{V}{R} = \frac{30}{8.64} = 3.47A$ (Proved) V= 30V and R = 8.64 Ω

Now Calculate current of the circuit I_1 , I_2 , I_3, I_4 , I_4 and I_5

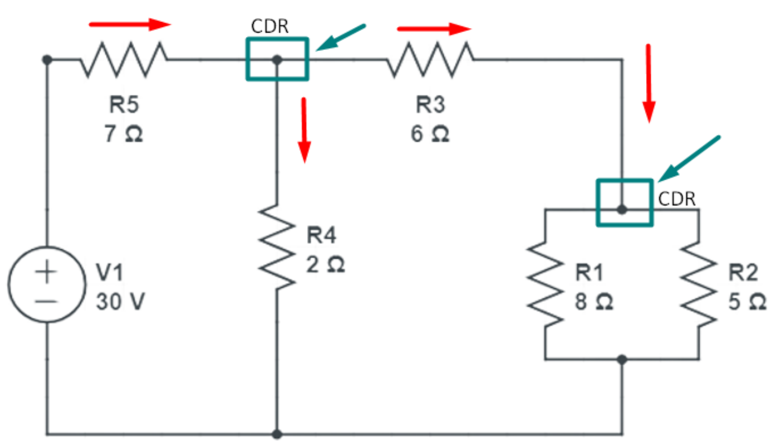


Fig: circuit analysis

Here,

R_{total} = 8.64 Ω
Voltage = 30V
Current = 3.47A
R_1 Resistance to through 3.47 A

Now Calculate R_3 and R_4 Resistance of their current using CDR formula:

$I_4 = \frac{R_3}{R_4+R_3} \times I_{total(Input)} = \frac{9.07}{9.07+2} \times 3.47 = \frac{31.47}{11.07} = 2.84A$ $\quad$ $\boldsymbol{Where, R_3}$ **= 9.07 Ω and** $\boldsymbol{R_4}$ **= 2** Ω

$I_3 = I_{total(input)} - I_4 = 3.47 - 2.84 = 0.63A$ $\quad$ $\boldsymbol{Where\ , I_{total(input)} = 3.47\ and\ I_4 = 2.84\ A}$

Now Calculate R_2 and R_1 Resistance of their current using CDR formula:

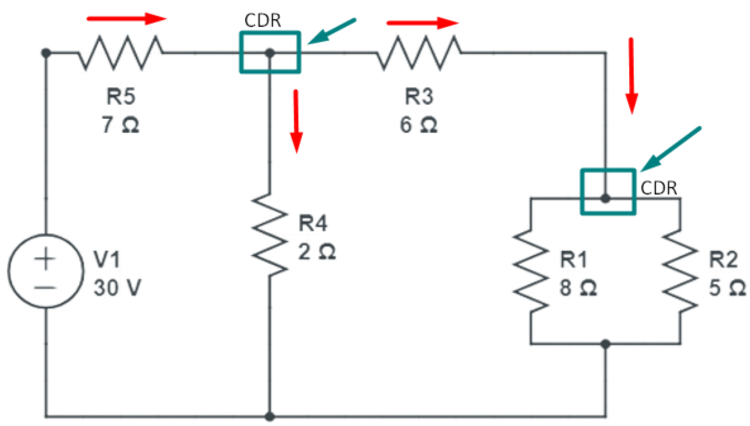
$I_1 = \frac{R_2}{R_2+R_1} \times I_{3(input)} = \frac{5}{8} \times 0.63 = \frac{3.15}{13} = 0.24A$ $\quad$ $\boldsymbol{Where, R_3}$ **= 9.07 Ω and** $\boldsymbol{R_4}$ **= 2** Ω

$I_2 = I_{3(total)} - I_1 = 0.63 - 0.24 = 0.39\ A$ $\quad$ $\boldsymbol{Where, I_{3(total)} = 0.63A\ and\ I_1 = 0.24A}$

I_2 or 5 Resistance to through current flow 0.39A (Proved)

2.4.2 Analysis the current and power

Now Calculate current of the circuit I_1 , I_2 , I_3, I_4 , I_4 and I_5



Here,

R_{total} = 8.64 Ω
Voltage = 30V
Current = 3.47A

Now Calculate R_3 and R_4 Resistance of their current using CDR formula:

$I_4 = \frac{R_3}{R_4+R_3} \times I_{total(Input)} = \frac{9.07}{9.07+2} \times 3.47 = \frac{31.47}{11.07} = 2.84A$ $Where, R_3$ = 9.07 Ω and R_4 = 2 Ω

$I_3 = I_{total(input)} - I_4 = 3.47 - 2.84 = 0.63A$ $Where, I_{total(input)} = 3.47$ and $I_4 = 2.84\ A$

Now Calculate R_2 and R_1 Resistance of their current using CDR formula:

$I_1 = \frac{R_2}{R_2+R_1} \times I_{3(input)} = \frac{5}{8} \times 0.63 = \frac{3.15}{13} = 0.24A$ $Where, R_3$ = 9.07 Ω and R_4 = 2 Ω

$I_2 = I_{3(total)} - I_1 = 0.63 - 0.24 = 0.39\ A$ $Where, I_{3(total)} = 0.63A$ and $I_1 = 0.24A$

Current of circuit every resistance is following:

$I_1 = 0.24A$
$I_2 = 0.39A$
$I_3 = 0.63A$
$I_4 = 0.28A$
$I_5 = 3.47A$

Now Calculate the power absorbed by the 6Ω resistor.

The formula of Power: $P = \frac{V^2}{R} = I^2R$

Power by the 6 Ω resistance: $P = I^2R = 0.63^2 \times 6 = 2.38\ Watt$

Task- 2.Q5

2.5 Encounter circuit to resolving the circuit analysis

Resolving both series and parallel circuit to identify the current divider rules (CDR), voltage divider rules (VDR), and resistance (R) using Ohm's Law can lead to several potential issues.

Series Circuit

In a series circuit, the components are connected end-to-end, one after the other. The current flows through each component in the same order, and the same current flows through all the components. The total resistance of a series circuit is the sum of the individual resistances of the components.

Parallel Circuit

In a parallel circuit, the components are connected side-by-side. The current is divided between the components, and each component has the same voltage across it. The total resistance of a parallel circuit is less than the resistance of any of the individual components.

Fundamental concept of circuit

- ***Current:*** In a series circuit, the same current flows through all the components. In a parallel circuit, the current is divided between the components.
- ***Voltage:*** In a series circuit, the voltage is divided between the components. In a parallel circuit, the same voltage is applied to all the components.
- ***Resistance:*** In a series circuit, the total resistance is the sum of the individual resistances of the components. In a parallel circuit, the total resistance is less than the resistance of any of the individual components.

Ohm's Law

Ohm's law is a law in electricity that states that the voltage or potential difference between two points is directly proportional to the current or electricity passing through the resistance, and directly proportional to the resistance of the circuit.

$V = I \times R$ *(V = voltage, I = current, R = resistance)*

Resolving both series and parallel circuits involves calculating the total resistance, voltage, and current in the circuit.

- Identifying Series and Parallel Connections
- Calculating Resistance in Series
- Calculating Resistance in Parallel
- Calculating Voltage and Current
- Simplifying Complex Circuits
- Using Circuit Diagrams
- Finally Checking Calculations

Mr. Tusher might encounter the following issues when resolving QA and QB:

- *Misunderstanding the circuit diagram:* Mr. Tusher might not fully understand the circuit diagram and how the resistors are connected. This could lead to incorrect calculations of current and power.
- *Making arithmetic errors***:** Mr. Tusher might make arithmetic errors when calculating current, power, and resistance. This could lead to inaccurate results.
- *Not considering the units of measurement:* Mr. Tusher might not properly consider the units of measurement when calculating current, power, and resistance. This could lead to confusion and incorrect results.
- *Complexity of the Circuit:* If the circuit is more complex, involving both series and parallel connections, solving it might become challenging.
- *Incorrect Assumptions:* If Mr. Tusher makes incorrect assumptions about the circuit configuration or overlooks certain details, it could lead to inaccurate results.
- *Unit Conversions:* Careful attention to unit conversions is crucial, as mixing different units for current, voltage, and resistance can lead to erroneous results.

To address these issues, it's essential to have a thorough understanding of Ohm's Law, circuit analysis principles, and the properties of the materials used in the circuit. Careful attention to detail, double-checking calculations, and using appropriate numerical methods can help minimize errors and improve the accuracy of circuit analysis.

Task- 2.Q6

2.6.1 Visualize the node analysis circuit

Visualize the circuit diagram based on the scenario.

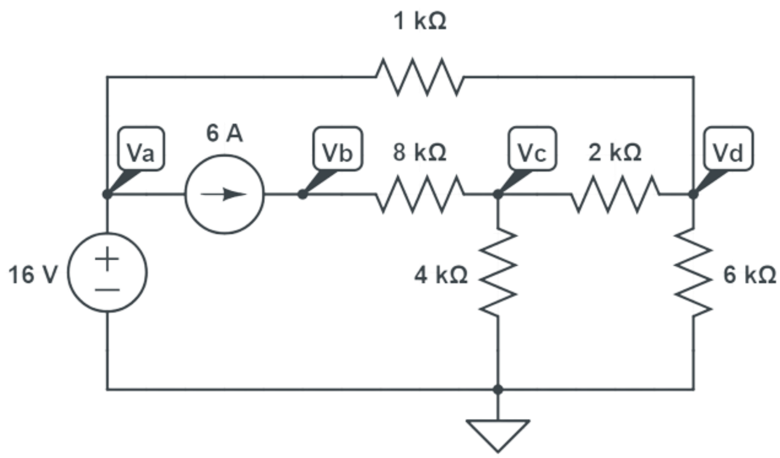


Fig: Node analysis circuit

2.6.2 Determine the node voltages

V_a is connected on voltage source so that $V_a = 16V$

V_e is reference Node so that $V_a = 0V$

V_b Node to using the KCL formula:

⇨ $\frac{V_b - V_c}{8000} - 6 = 0$

⇨ $V_b - V_c = 48000$ I

V_c Node to using the KCL formula:

⇨ $\frac{V_c - V_b}{8000} + \frac{V_c}{4000} + \frac{V_c - V_d}{2000} = 0$

⇨ $V_c - V_b + 2V_c + 4V_c - 4V_d = 0$ (8000 multiples by both side)

⇨ $-(V_b - V_c) + 6V_c - 4V_d = 0$

⇨ $-48000 + 6V_c - 4V_d = 0$ using values of equation (I)

⇨ $6V_c - 4V_d = 48000$ II

V_d Node to using the KCL formula:

⇨ $\frac{V_d}{6000} + \frac{V_d - V_c}{2000} + \frac{V_d - V_a}{1000} = 0$

⇨ $V_d + 3V_d - 3V_c + 6V_d - 6V_a = 0$ 6000 multiples by both side

⇨ $10V_d - 3V_c - 6 \times 16 = 0$ replace value of V_a=16

⇨ $10V_d - 3V_c = 96$ III

Now calculate the equation of II & III to using scientific calculator:

$\Rightarrow$ $\boldsymbol{V_c = 10{,}008\ V = 10.08\ kV}$

$\Rightarrow$ $\boldsymbol{V_d = 3012\ V = \quad 3.012\ kV}$

V_c value to replace the equation I:

$\Rightarrow$ $\boldsymbol{V_b = 58008\ V = 58.008\ kV}$

Finally Results of Node Voltages are:

$\Rightarrow$ $\boldsymbol{V_a = 16\ V \qquad = 16.0000\ V}$

$\Rightarrow$ $\boldsymbol{V_b = 58008\ V \quad = 58.008\ kV}$

$\Rightarrow$ $\boldsymbol{V_c = 10{,}008\ V \quad = 10.080\ kV}$

$\Rightarrow$ $\boldsymbol{V_d = 3012\ V \qquad = 3.0120\ kV}$

$\Rightarrow$ $\boldsymbol{V_e = 0V \qquad\qquad = 0.0000\ kV}$

2.6.3 Voltage and current from the 4 kilo-ohm and 1 kilo-ohm resistors

1 kilo-ohm

Using Ohm's Law formula:

We Know that,

Current

$\Rightarrow$ $I = \frac{V}{R}$

$\Rightarrow$ $I = \frac{V_d - V_a}{R}$

$\Rightarrow$ $I = \frac{3012-16}{1000} = 2.996\ A$

Voltage

$\Rightarrow$ $V = I \times R$

$\Rightarrow$ $V = 2.996\ \times 1000 = 2996\ V$

4 kilo-ohm

Using Ohm's Law formula:

We Know that,

Current

$\Rightarrow$ $I = \frac{V}{R}$

$\Rightarrow$ $I = \frac{V_c}{R}$

$\Rightarrow$ $I = \frac{10008}{4000} = 2.502\ A$

Voltage

$\Rightarrow$ $V = I \times R$

$\Rightarrow$ $V = 2.502\ \times 4000 = 10008\ V$

Conclusion

Throughout this semester project, we have delved into the fundamental concepts of electronic circuits, exploring the behavior of electrons and their interactions with various components. Through hands-on design, construction, and analysis, we have gained a deeper understanding of circuit principles and their practical applications.

The project's primary objective, to design and construct a simple electronic circuit, was successfully accomplished. We meticulously planned the circuit's layout, carefully selected appropriate components, and meticulously assembled the circuit board. The testing and analysis phase revealed the circuit's functionality and performance, allowing us to identify areas for improvement and potential optimization.

Reference

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