USER MANUAL

THEVENIN & NORTON TRAINER (TNT)

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9 789672 097891

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ABSTRACT

The TNT 1.0 project has been designed as a specific training tool for students to perform practical exercises on Thevenin and Norton circuit analysis in the DET 10013 – Electrical Technology course. Previously, students faced difficulties in carrying out practical exercises due to the time-consuming process of building circuits using basic components. Students also have difficulty understanding the concept of TNT circuit assembly. In addition, the traditional setup requires students to connect the power supply to the built circuit, which directly raises safety concerns for students. TNT training kits aim to address this challenge by providing a simple and efficient solution for students. This tool streamlines the process of building Thevenin and Norton circuits, allowing students to complete hands-on exercises quickly and effectively. Including safety features in TNT ensures a safe learning environment, addressing student safety issues with the need for direct power supply connection to the circuit. By using the TNT kit, students can gain a better understanding of Thevenin and Norton's theory through practical application. Real-time display of voltage and current readings facilitates understanding of simple theoretical concepts, enhancing the overall learning experience. The TNT 1.0 project not only simplifies the practical aspects of circuit analysis but also prioritizes safety, making it an invaluable resource for students involved in hands-on electrical engineering education.

PREFACE

This manual is intended for new users with little or no experience using the Thevenin & Norton Trainer(TNT). The goal of this document is to give an overview of the main functions of TNT and some basic instructions on how to set up and make a connection during lab work. This document will concentrate on demonstrating interaction with TNT using this trainer. Every effort has been made to ensure that this document is an accurate representation of the functionality of TNT. The following documentation conventions have been used in this manual:

- Introduction
- Layout, specification, overview, TNT in load
- Practical Work

SAFETY PRECAUTIONS

To prevent damage to the property or injury to yourself or to others, read “For Your Safety”in its entirety before using this trainer.

Keep these safety instructions where all those who use this trainer will read them:

- Always see that power is connected to your equipment through a circuit breaker
- Connect the power source last. Disconnect the power source first.
- Never make wiring changes on live circuits. TURN OFF power source before make connections.
- Before connecting the power, check your wiring carefully for agreement with the wiring diagram for an accidental short-circuit and for loose connections.
- Do not cause short-circuits or high currents arcs. Burn from arcs may be very severe even at a distance of a few meters. Report all electrical burns to your instructor.
- Be careful to keep metallic accessories of apparel or jewelry out of contact with live circuit part.
- When using a multiple range meter always use the high range first to determine the feasibility of using a lower range.

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Chapter 1

INTRODUCTION

HISTORY OF THEVENIN AND NORTON TRAINER

The Thevenin and Norton Theorems in Circuit Theory

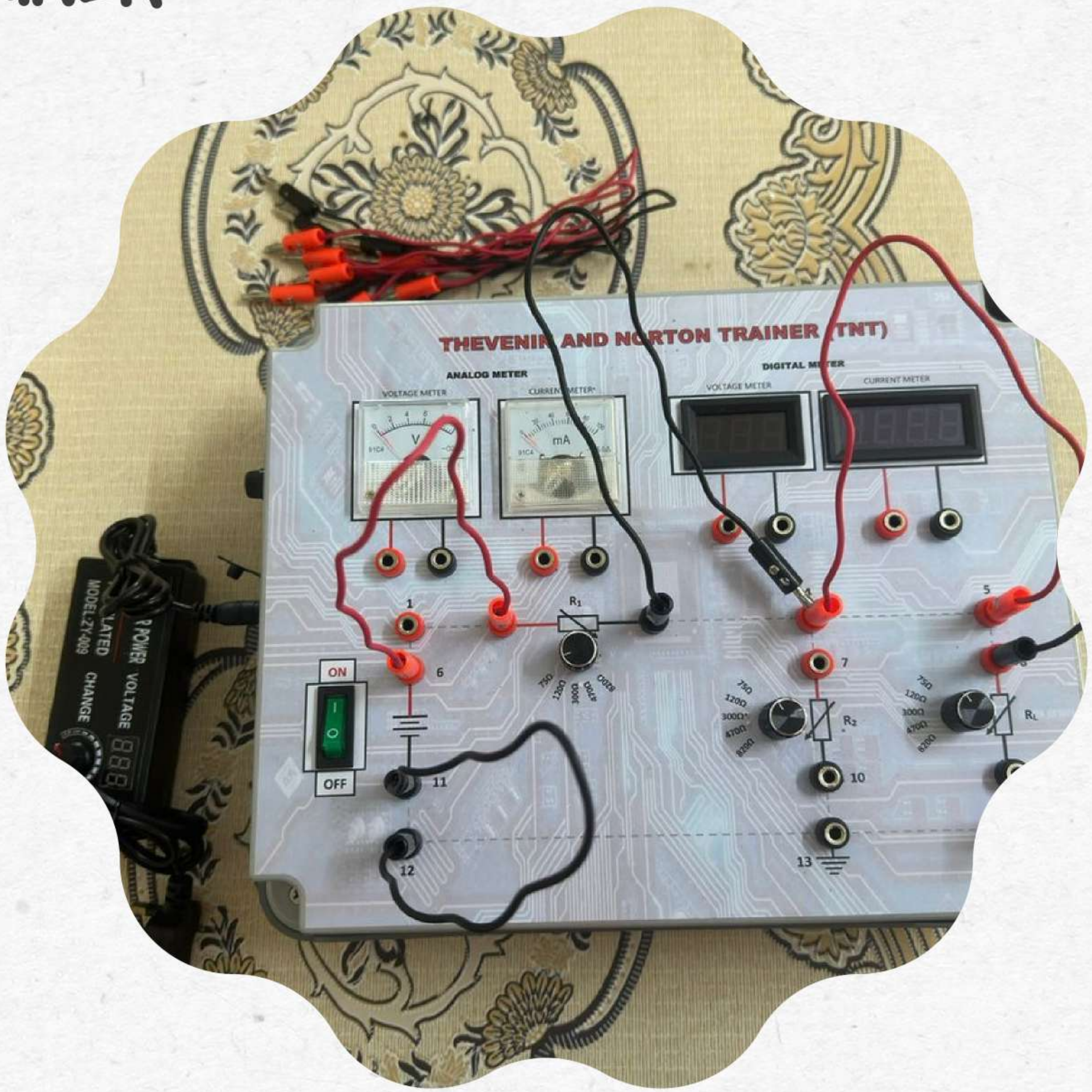
The theorems of Thevenin and Norton stand as fundamental principles widely applied across various tasks in circuit theory [1]. From basic source modelling to intricate examinations of electrical machinery and power systems, these theorems play a pivotal role in streamlining the analysis of complex circuits [1].

These two significant theorems, Norton and Thevenin, are considered essential tools for simplifying the analysis of complicated circuits [2]. They are particularly applied to compute voltages and currents across a single component in a circuit known as the load. However, it is acknowledged that back substitutions are necessary to determine values in the remaining components of the circuit [2]. Engineers generally hold the belief that once a circuit is reduced to its Thevenin or Norton equivalent, the voltage and current can only be found at the load and not in other components [2].

HISTORY OF THEVENIN AND NORTON TRAINER

The Thevenin and Norton models simplify circuits by isolating the terminal behaviour of linear components that provide energy and signal the circuit as a whole. Analog circuits can be analysed using these models in many ways, such as source transformation, DC analysis, and AC analysis (frequency/phasor and s-domain) [5, 6, 7, 8].

This shift in perspective simplifies the analysis by comparing equivalent resistance and voltage, making it more straightforward in less complex circuits.



HISTORY OF THEVENIN AND NORTON TRAINER

The TNT 1.0 Project: Addressing Challenges in Circuit Analysis Education

The TNT 1.0 project was specifically designed to serve as a training tool for students engaging in Thevenin and Norton circuit analysis experiments. Students faced difficulties in conducting practical exercises, encountering challenges in building circuits with basic components and comprehending the concept of TNT circuit assembly. Moreover, the traditional setup, which required students to connect the power supply directly to a built-in circuit, raised safety concerns.

To address these challenges and achieve high learning outcomes, the TNT training kit offers simple and efficient solutions for students [3]. By streamlining the process of building Thevenin and Norton circuits, the tool enables students to complete practical exercises quickly and effectively. The inclusion of safety features ensures a secure learning environment, eliminating the need for direct power connections and addressing student safety concerns [3].

HISTORY OF THEVENIN AND NORTON TRAINER

Modern Technologies Transforming Learning Practices

In the context of education, the development of contemporary technologies has significantly impacted learning practices. The introduction of new technologies aimed at enhancing learning effectiveness and efficiency has reshaped traditional educational approaches.

Face-to-face lectures are highlighted as providing a more enjoyable and effective learning experience [4]. The integration of the TNT kit further enhances the learning experience by allowing students to gain a better understanding of Thevenin and Norton theory through practical application. The real-time display of current and voltage readings facilitates easy comprehension of theoretical concepts, making the TNT project an invaluable resource for students directly involved in Electrical Engineering Education.

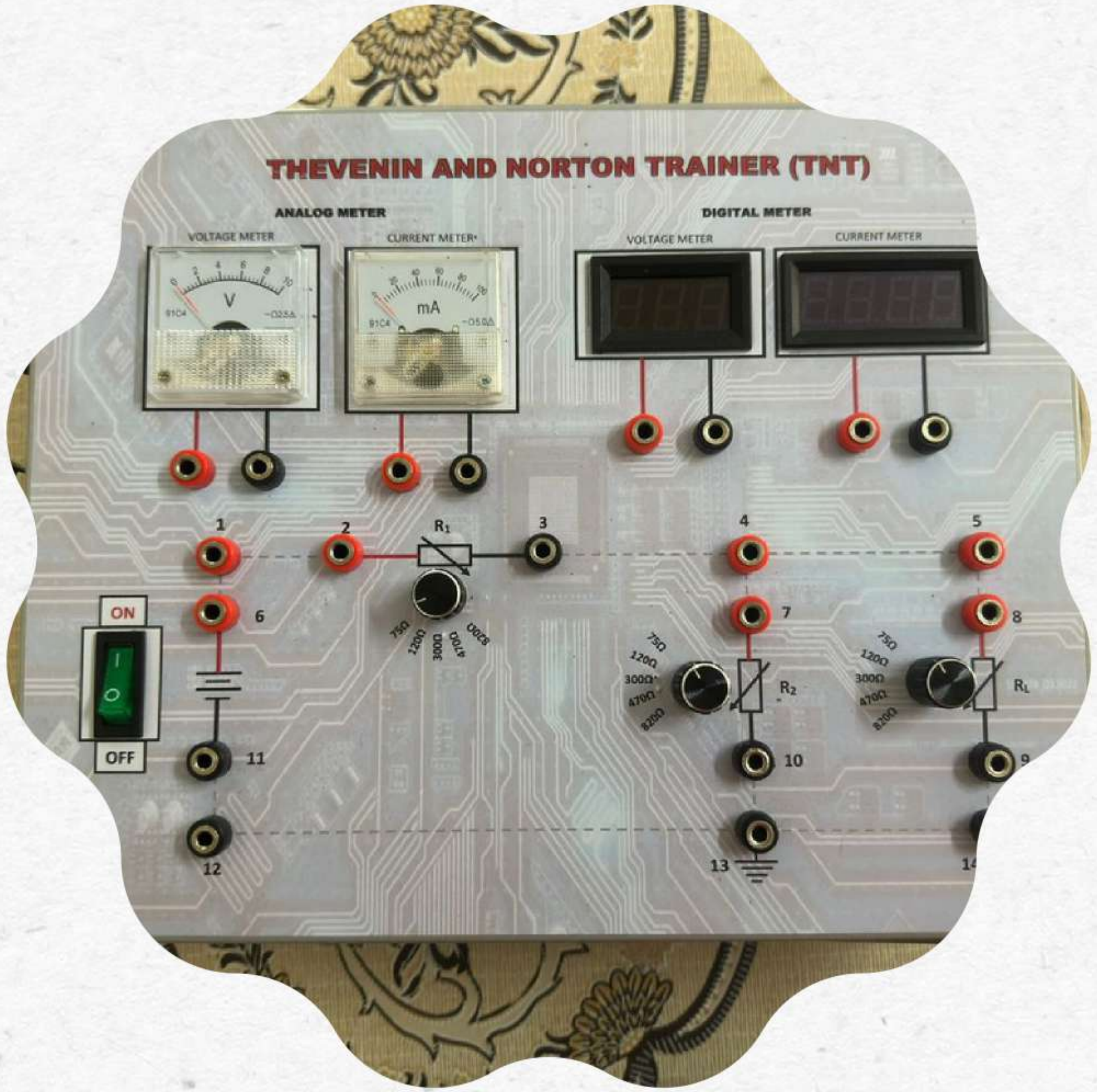
HISTORY OF THEVENIN AND NORTON TRAINER

In conclusion, the literature review emphasizes the foundational role of Thevenin and Norton theorems in circuit theory, introduces the challenges faced by students in circuit analysis education, and highlights the innovative solutions offered by the TNT 1.0 project. The focus on safety, practical application, and integration with contemporary learning technologies positions TNT as a transformative tool in electrical engineering education.

GENERAL PRINCIPLES OF THEVENIN AND NORTON TRAINER

Thevenin's Theorem and Norton's Theorem are two fundamental principles in electrical circuit analysis that simplify complex linear circuits into simpler equivalent circuits. Both theorems are applicable to linear, time-invariant circuits and are often used to analyze and design electronic circuits. Here are the general principles of Thevenin's and Norton's Theorems:

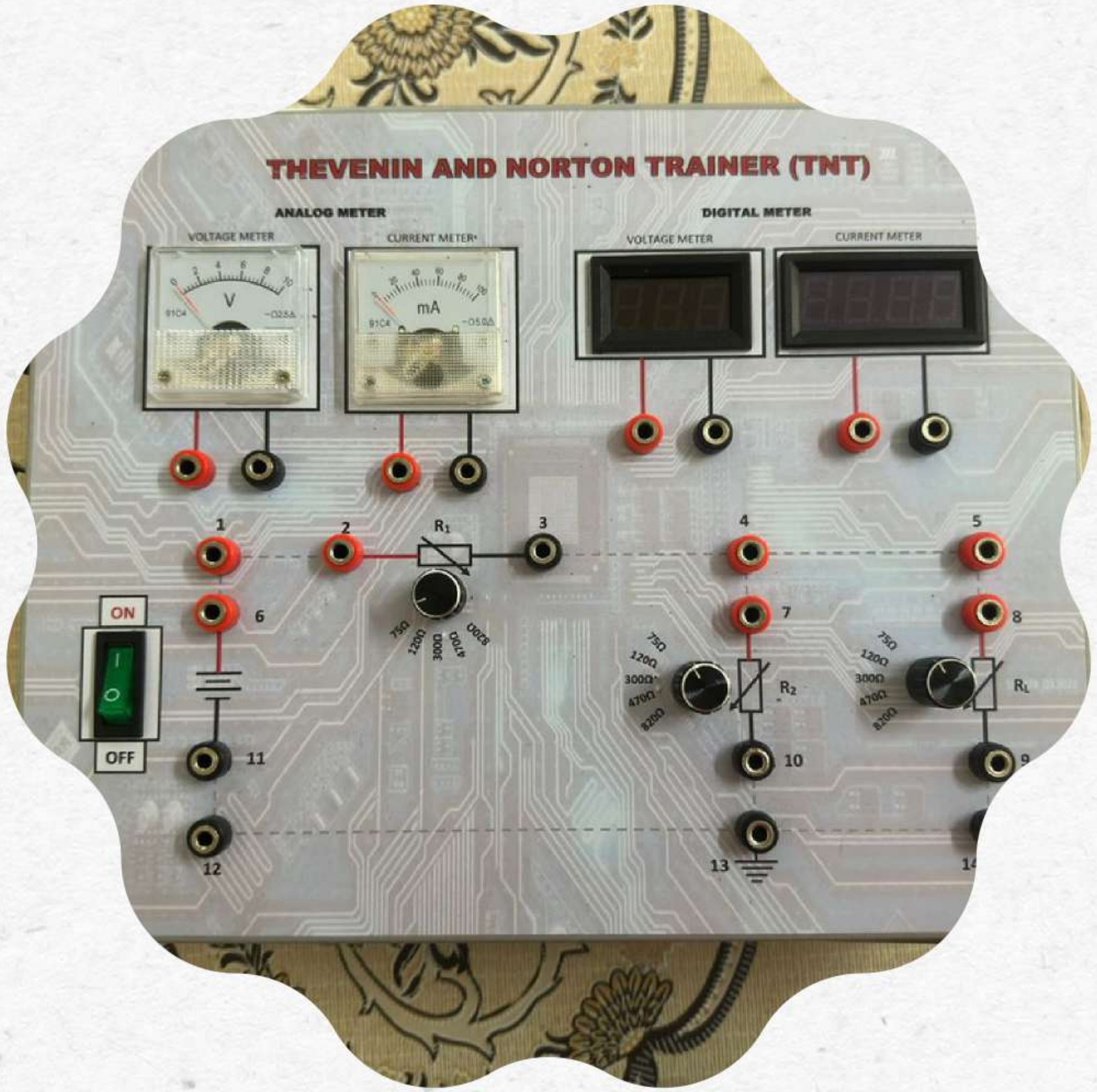
- Statement: Any linear, time-invariant circuit containing resistors, voltage sources, and current sources can be replaced by an equivalent circuit consisting of a single voltage source (Thevenin voltage) in series with a single resistor (Thevenin resistance).
- Thevenin Voltage (Vth): The open-circuit voltage at the terminals of interest when all independent sources are turned off (replaced by short circuits).
- Thevenin Resistance (Rth): The equivalent resistance at the terminals of interest when all independent sources are turned off (replaced by short circuits and dependent sources treated as their internal resistances).
- Equivalent Thevenin Circuit:
- Application: Thevenin's Theorem is often used to simplify complex circuits, making it easier to analyze and solve for currents and voltages.



GENERAL PRINCIPLES OF THEVENIN AND NORTON TRAINER

- Statement: Any linear, time-invariant circuit containing resistors, voltage sources, and current sources can be replaced by an equivalent circuit consisting of a single current source (Norton current) in parallel with a single resistor (Norton resistance).
- Norton Current (IN): The short-circuit current at the terminals of interest when all independent sources are turned off (replaced by open circuits).
- Norton Resistance (RN): The equivalent resistance at the terminals of interest when all independent sources are turned off (replaced by open circuits and dependent sources treated as their internal resistances).
- Equivalent Norton Circuit:
- Application: Norton's Theorem is particularly useful in analyzing and solving for currents in circuits, providing an alternative perspective to Thevenin's Theorem.

These theorems are powerful tools for simplifying circuit analysis and are often used in combination to solve complex circuits more efficiently. They are particularly valuable for designing and troubleshooting electronic circuits.

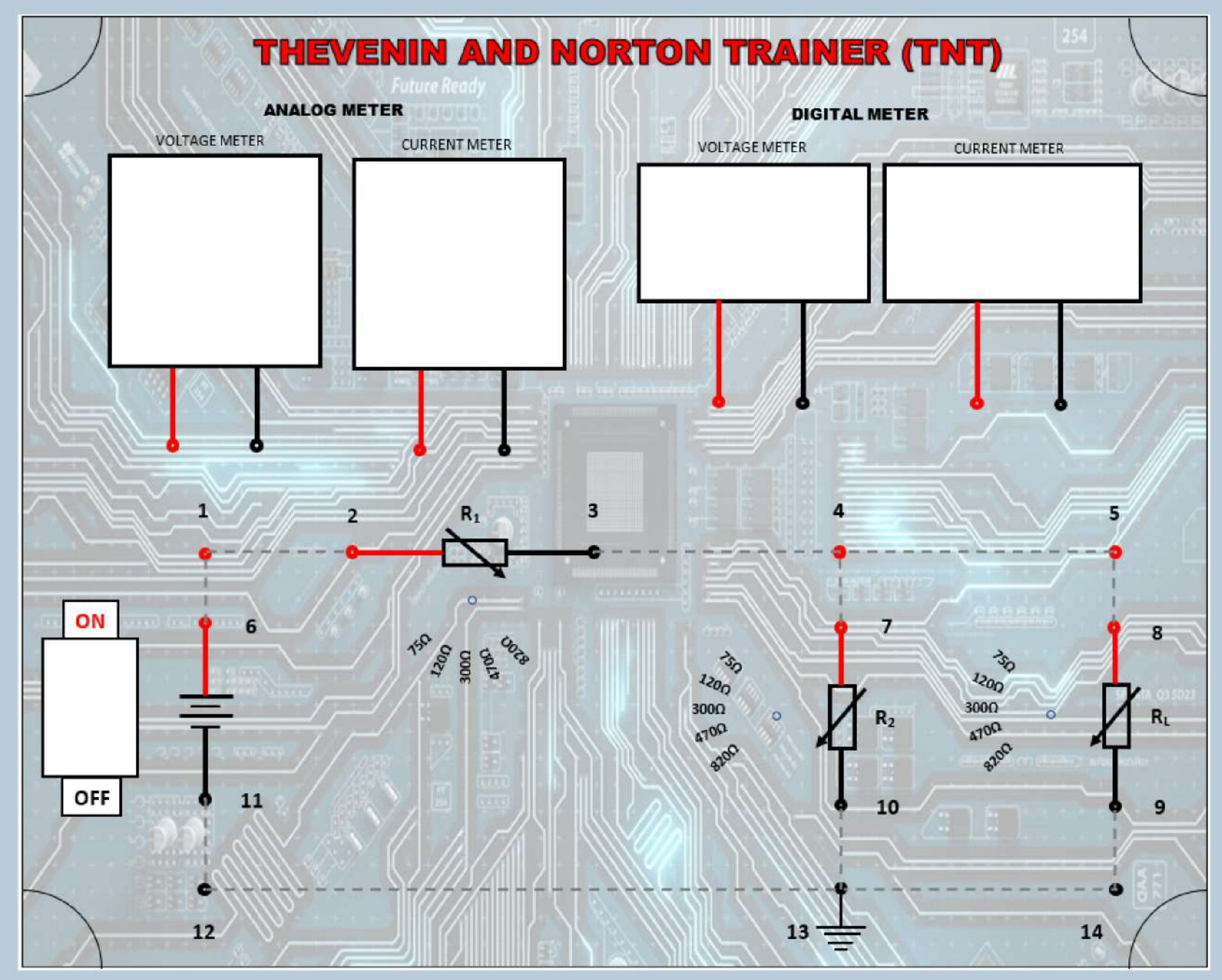


Chapter 2

GETTING STARTED

THEVENIN & NORTON TRAINER (TNT)

LAYOUT



Thevenin & Norton Trainer Layout

SPECIFICATION & OVERVIEW

SPECIFICATION

1. Input :
   - Single phase AC 230V 50Hz converted to DC 3-24V

2. Output:
   - DC 3-24V from circuits

3. DC analog Voltmeter & Ammeter
4. DC Digital Voltmeter & Ammeter
5. Overload protection fuse 5A

OVERVIEW

TNT contains four(4) parts:

- Power switch
- Analog Voltmeter and Ammeter
- Digital Voltmeter and Ammeter
- Variable selector resistor

POWER SWITCH

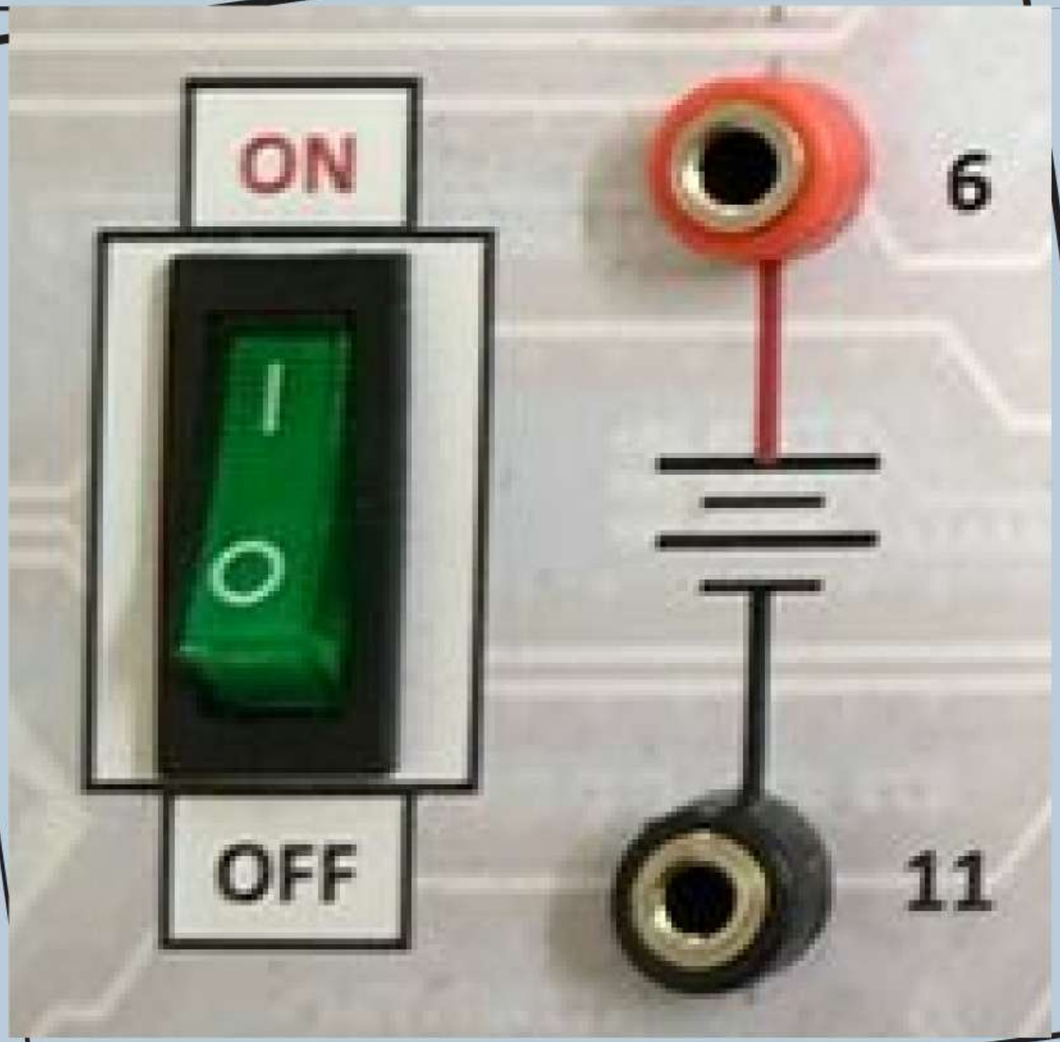


Figure 2.1 Power Switch

The figure 2.1 show power switch for controlling input DC 3-24V where it will give supply to circuits in the trainer.

the switching will give extra safety to consumers which avoid electric shock

ANALOG VOLTMETER AND AMMETER

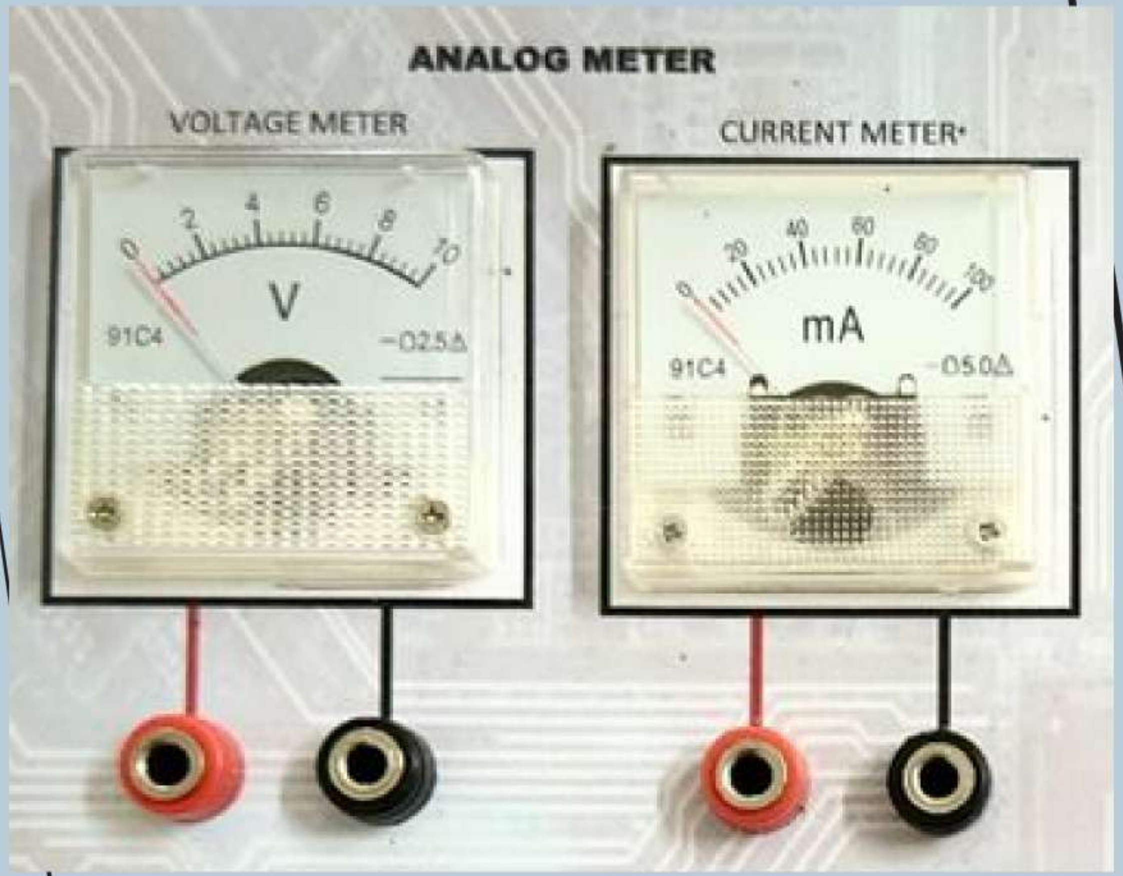


Figure 2.2 Analog Meter

The figure 2.2 show Analog meter to measure voltage and current.

DIGITAL VOLTMETER AND AMMETER

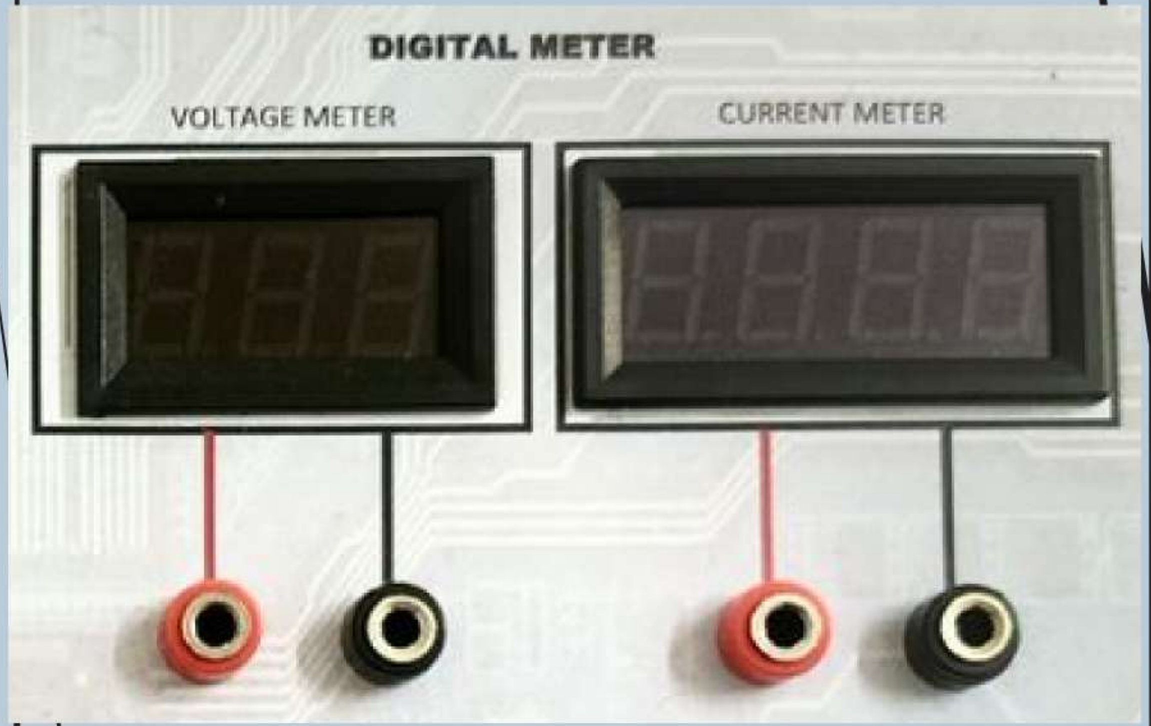


Figure 2.3 Digital Meter

The figure 2.3 show Digital meter to measure voltage and current.

VARIABLE SELECTOR RESISTOR

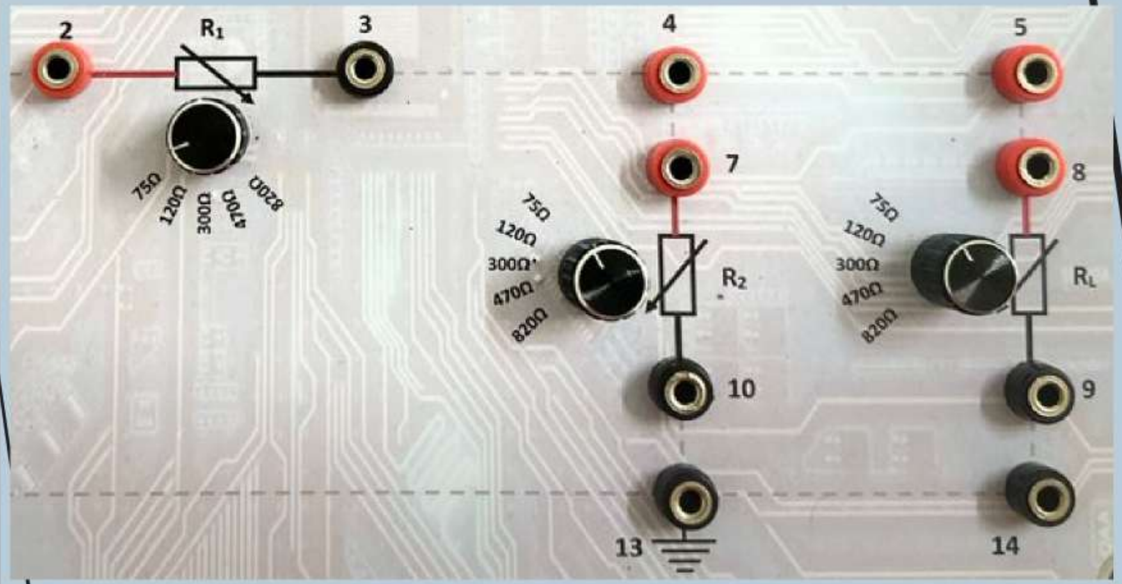


Figure 2.4 Variable selector resistor

The figure 2.4 show Variable selector resistor to create a Thevenin or Norton circuit.

Chapter 3

PRACTICAL WORK

POLITEKNIK MALAYSIA MUKAH

Program	DEE / DEP
Practical work Number	5
Title	THEVENIN AND NORTON THEOREM
Lecturer's Name	

No	REGISTRATION NO	STUDENT NAME	A. PRACTICAL SKILL ASSESSMENT RUBRIC (CLO2)	B. LAB REPORT ASSESSMENT	C. TOTAL MARKS	D. GENERIC SKILL ASSESSMENT (CLO3)
1.						
2.						
3.						
4.						

POLITEKNIK MALAYSIA MUKAH	COURSE	DET10013: ELECTRICAL TECHNOLOGY
	TITLE	THEVENIN AND NORTON THEOREM
	PRACTICAL WORK	5
	CLO	2

Upon completion of the experiment, students should be able to:

1. Construct the Thevenin's voltage (VTH) and resistance (RTH)
2. Construct the Thevenin's equivalent circuit
3. Construct the Norton's voltage (VN) and resistance (RN)
4. Construct the Norton's equivalent circuit

APPLICATION: Laboratory assessment

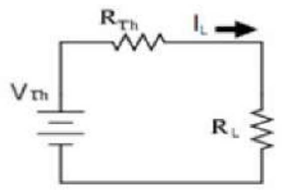
EQUIPMENT AND COMPONENTS:

No	Equipment / Component Quantity	
1	DC Power Supply 1 unit	
2	Multimeter 1 unit	
3	Breadboard 1 unit	
4	Resistor 75 Ω 1 unit	
5	Resistor 200 Ω 1 unit	
6	Resistor 300 Ω 1 unit	

THEORY:

Thevenin's Theorem Norton's Theorem

"For the purpose of determining load current , I_L ; a network can be simplified with a single source of e.m.f,V_{TH} and a series resistor, R_{TH} and R_L"



Steps in details :

(1) **Remove R_L** from the circuit terminals and redraw the circuit.

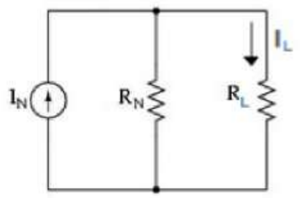
(2) Find the **Thevenin voltage (V_{TH})** at open circuit R_L terminal

(3) Determine **Thevenin resistance (R_{TH})** – short circuit V_T and R_L termir

(4) Draw the resulting Equivalent Thevenin's Circuit (**ETC**)

(5) Calculate load current using formula $I_L = \frac{Vth}{Rth + R_L}$

"Any two terminal dc networks can be replaced by an equivalent circuit consisting of a current source, I_N and a parallel resistor of R_N and R_L"



Steps in details :

(1) **Remove R_L** from the circuit terminals and redraw the circuit

(2) Find the **Norton current (I_N)** at open circuit R_L terminal (short circuit terminal)

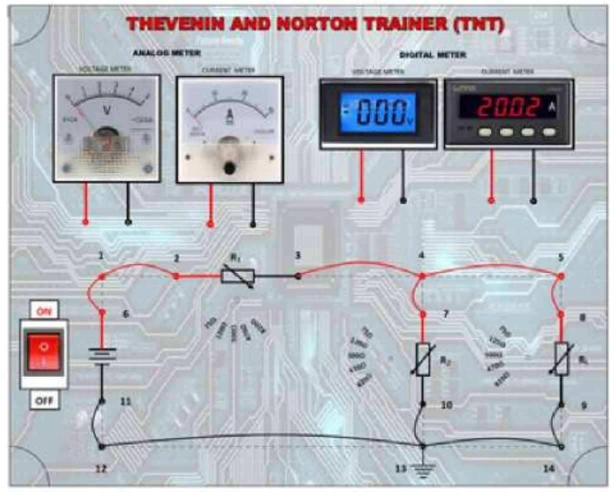
(3) Find the **Norton resistance (R_N)** – terminal remain short circuit

(4) Draw the resulting Equivalent Norton's Circuit (**ENC**)

(5) Calculate load current using formula $I_L = \frac{RN}{RN + RL} \times I_N$

PROCEDURE:

Thevenin's Theorem



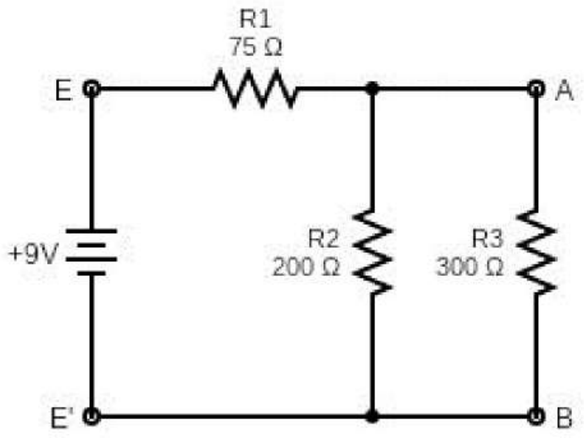
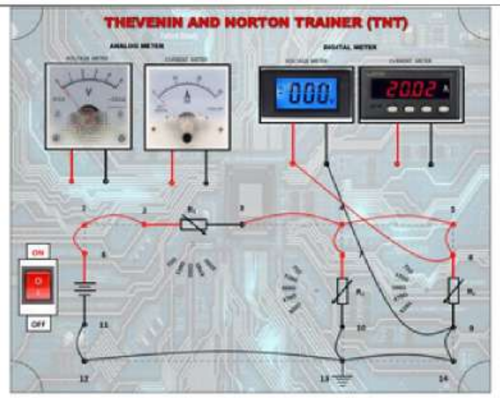
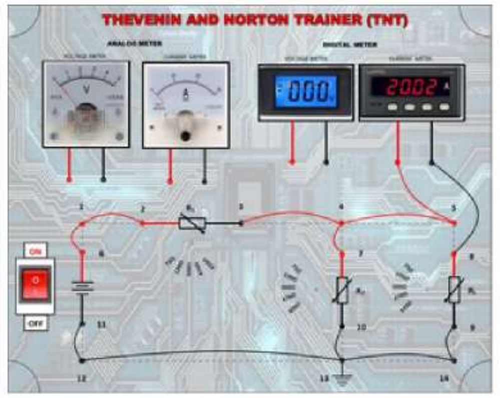


Figure 1

1. Construct the circuit as shown in Figure 1.
2. Connect a 9V DC voltage to the circuit and switch on the power supply.
3. Measure the load voltage VL and load current IL at terminal AB.
4. Record the result picture in **Table 1**.

Table 1

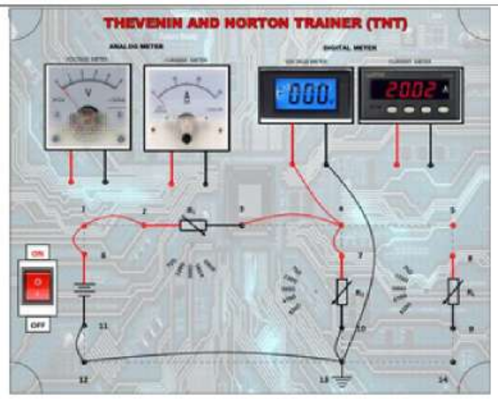
Result picture of verifying the Thevenin's and Norton's Theorem
 Measuring voltage VL  Measuring current IL

Step by step procedure to obtain Thevenin Equivalent Circuit:

a) To find VTH

1. Switch off the power supply and remove the load resistance, RL from the output terminal AB.
2. Switch on the DC power supply and measure the voltage across the output terminals AB and record this reading as VTH.
3. Record the result picture circuit with reading of VTH in **Table 2.**

Table 2:

Result picture of the circuit with V^{TH}
 Measuring Voltage VTH

b) To find RTH

1. Switch off the DC power supply and removed the supply from the circuit and shorted the terminal EE'.
2. Measure the total resistance at terminal AB and record this resistance as RTH.
3. Record the result picture of circuit with the reading of RTH in **Table 3.**

Table 3:

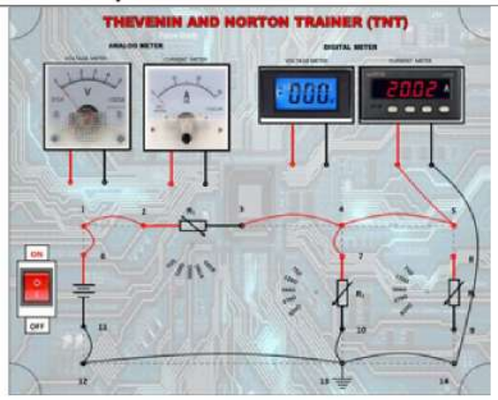
Result picture of the circuit with RTH
 Measuring resistance R^{TH}

Step by step procedure to obtain Norton Equivalent Circuit:

a) To find IN

1. Switch off the power supply and remove the load resistance, RL from the output terminal AB and replace it with a short circuit.
2. Switch on the DC power supply and measure the voltage across the output terminals AB and record this reading as IN.
3. Record the result picture of circuit with reading of IN in **Table 5**.

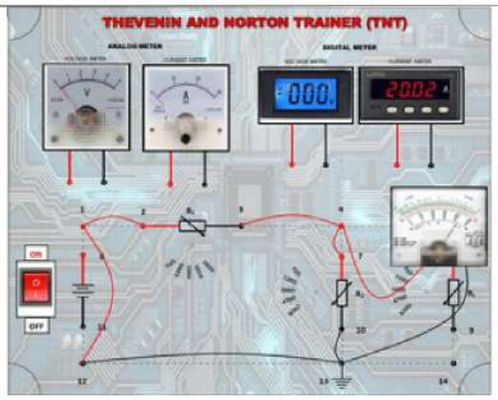
Table 5:

Result picture of the circuit with IN

Measuring current IN

b) To find RN

1. Switch off the DC power supply and removed the supply from the circuit and shorted the terminal EE'.
2. Measure the total resistance at terminal AB (open circuit) and record this resistance as RN.
3. Record the result picture of circuit with the reading of RN in **Table 6.**

Table 6:

Result picture of the circuit with RN

Measuring resistance RN

DISCUSSION:

1. Calculate the Figure 1 by using Thevenin’s Theorem.
2. Calculate the Figure 1 by using Norton’s Theorem.
3. Observed the value of current and voltage form Table 1 with Table 4 and Table 7.

CONCLUSION:

Write a conclusion based on your work in this practical session.

DET10013: ELECTRICAL TECHNOLOGY
PRACTICAL WORK 5: PRACTICAL SKILL ASSESSMENT RUBRIC

CLO / CLUSTER (CLS)	DT	SKILLS / ASPECT	SCORE DESCRIPTION					WEIGH	SCORE STUDENT 1	SCORE STUDENT 2	SCORE STUDENT 3	SCORE STUDENT 4
			EXCELLENT	VERY GOOD	GOOD	AVERAGE	UNSATISFACTORY					
			5	4	3	2	1					
CLO 2: Construct and measure related electrical parameters using appropriate electrical equipment CLS: 3a – Practical Skills	P3	Construct the circuit for **Table 1**	Able to construct the circuit without assistance	Able to construct the circuit with little assistance	Able to construct the circuit with more assistance	Able to construct the circuit with assistance	Unable to construct the circuit	× 1				
	P4	Measure the currents for **Table 1**	Able to measure the currents without assistance	Able to measure the currents with little assistance	Able to measure the currents with more assistance	Able to measure currents resistance with assistance	Unable to measure the currents	× 1				
	P4	Construct the voltage for **Table 1**	Able to measure the voltage without assistance	Able to measure the voltage with little assistance	Able to measure the voltage with more assistance	Able to measure voltage resistance with assistance	Unable to measure the voltage	× 1				
	P3	Construct the circuit for **Table 2**	Able to construct the circuit without assistance	Able to construct the circuit with little assistance	Able to construct the circuit with more assistance	Able to construct the circuit with assistance	Unable to construct the circuit	× 1				
	P4	Measure the voltage for **Table 2**	Able to measure the voltage without assistance	Able to measure the voltage with little assistance	Able to measure the voltage with more assistance	Able to measure voltage resistance with assistance	Unable to measure the voltage	× 1				
	P3	Construct the circuit for **Table 3**	Able to construct the circuit without assistance	Able to construct the circuit with little assistance	Able to construct the circuit with more assistance	Able to construct the circuit with assistance	Unable to construct the circuit	× 1				
	P4	Measure the total resistance for **Table 3**	Able to measure the total resistance without assistance	Able to measure the total resistance with little assistance	Able to measure the total resistance with more assistance	Able to measure total resistance with assistance	Unable to measure the total resistance	× 1				

DET10013: ELECTRICAL TECHNOLOGY
PRACTICAL WORK 5: PRACTICAL SKILL ASSESSMENT RUBRIC

CLO / CLUSTER (CLS)	DT	SKILLS / ASPECT	SCORE DESCRIPTION					WEIGHTAGE	SCORE STUDENT 1	SCORE STUDENT 2	SCORE STUDENT 3	SCORE STUDENT 4
			EXCELLENT	VERY GOOD	GOOD	AVERAGE	UNSATISFACTORY					
			5	4	3	2	1					
CLO 2: Construct and measure related electrical parameters using appropriate electrical equipment CLS: 3a – Practical Skills	P3	Construct the circuit for **Table 4**	Able to construct the circuit without assistance	Able to construct the circuit with little assistance	Able to construct the circuit with assistance	Able to construct the circuit with more assistance	Unable to construct the circuit	× 1				
	P4	Measure the currents for **Table 4**	Able to measure the currents without assistance	Able to measure the currents with little assistance	Able to measure the currents with assistance	Able to measure the currents with more resistance with	Unable to measure the currents	× 1				
	P4	Construct the voltage for **Table 4**	Able to measure the voltage without assistance	Able to measure the voltage with little assistance	Able to measure the voltage with more assistance	Able to measure resistance with	Unable to measure the voltage	× 1				
	P3	Construct the circuit for **Table 5**	Able to construct the circuit without assistance	Able to construct the circuit with little assistance	Able to construct the circuit with assistance	Able to construct the circuit with more assistance	Unable to construct the circuit	× 1				
	P4	Measure the currents for **Table 5**	Able to measure the currents without assistance	Able to measure the currents with little assistance	Able to measure the currents with assistance	Able to measure the currents with more resistance with	Unable to measure the currents	× 1				
	P3	Construct the circuit for **Table 6**	Able to construct the circuit without assistance	Able to construct the circuit with little assistance	Able to construct the circuit with assistance	Able to construct the circuit with more assistance	Unable to construct the circuit	× 1				
	P4	Measure the total resistance for **Table 6**	Able to measure the total resistance without assistance	Able to measure the total resistance with little assistance	Able to measure the total resistance with more assistance	Able to measure total resistance with assistance	Unable to measure the total resistance	× 1				

Chapter 4

REFERENCES AND APPENDIX

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APPENDIX

PRE & POST QUIZ

MUKAH

DEPARTMENT OF ELECTRICAL ENGINEERING
PRE & POST QUIZ: TNT

Name	
Class	
Registration No.	

Instruction:

Choose the suitable answer for each question

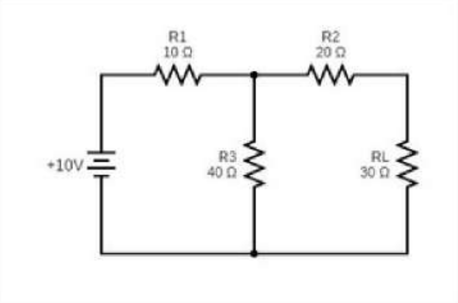
Question 5

Not yet answered

Marked out of 1.00

Flag question

Edit question



Using Thevenin Theorem, find the value for Vth

- A. 10V
- B. 2V
- C. 8V
- D. 3V

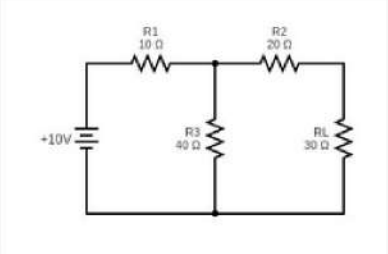
Question 6

Not yet answered

Marked out of 1.00

Flag question

Edit question



Using Thevenin Theorem, find the Thevenin Resistance Rth for the circuit

- A. 100 Ohm
- B. 28 Ohm
- C. 11 Ohm
- D. 40 Ohm

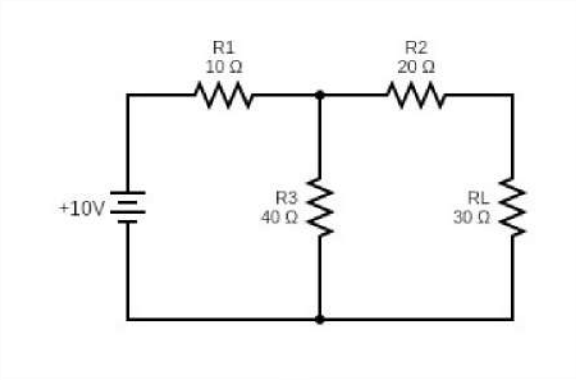
Question 7

Not yet answered

Marked out of 1.00

Flag question

Edit question



Calculate Norton's Current, I_N for the circuit above

- A. 1.8A
- B. 0.286A
- C. 2.14A
- D. 0.189A

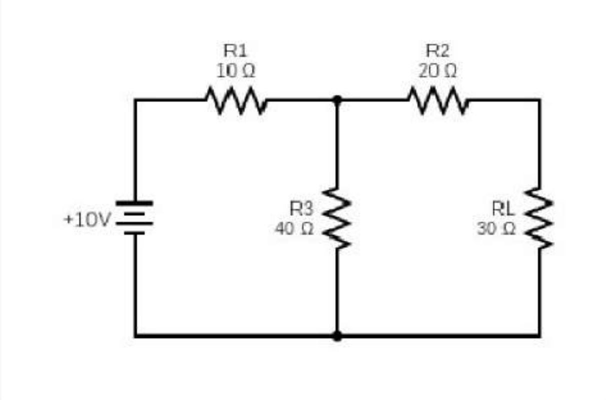
Question 8

Not yet answered

Marked out of 1.00

Flag question

Edit question



Find Norton's Total Resistance, R_N for the circuit

- A. 38 Ohm
- B. 28 Ohm
- C. 48 Ohm
- D. 58 Ohm

QUESTIONNAIRE FORM

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BORANG SOAL SELIDIK

Borang soal selidik ini adalah maklum balas mengenai:

TAHAP PENGGUNAAN INOVASI BAHAN BANTU MENGAJAR THEVENIN & NORTON TRAINER(TNT) BAGI KURSUS ELECTRICAL TECHNOLOGY (DET10013) DI JABATAN KEJURUTERAAN ELEKTRIK, POLITEKNIK MUKAH

Kajian ini dilaksanakan oleh **Jabatan Kejuruteraan Elektrik** bagi semua pelajar yang telah mengambil kursus ini bagi sesi 1 2023/2024. Kajian ini merupakan satu indikator penilaian penggunaan bahan inovasi ini bagi program Jabatan Kejuruteraan Elektrik.

Borang Soal Selidik ini mengandungi 3 bahagian iaitu:

- **Bahagian A : Demografi**
- **Bahagian B : Kreativiti**
- **Bahagian C : Minat**

Maklumbalas ini akan dapat membantu Jabatan Kejuruteraan Elektrik menilai tahap penggunaan inovasi bahan bantu mengajar ini dan membuat perancangan yang lebih komprehensif bagi kursus yang akan datang.

Nota :

Borang soal selidik yang telah lengkap diisi hendaklah dikemukakan ke :

Jabatan Kejuruteraan Elektrik
Politeknik Mukah
KM 7.5, Jalan Oya,
96400 Mukah,
Sarawak.
Tel:084-874001, Fax:084-874005

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BORANG SOAL SELIDIK
TAHAP PENGGUNAAN INOVASI BAHAN BANTU MENGAJAR THEVENIN & NORTON TRAINER(TNT) BAGI KURSUS ELECTRICAL TECHNOLOGY (DET10013) DI JABATAN KEJURUTERAAN ELEKTRIK, POLITEKNIK MUKAH

Borang soal selidik ini adalah untuk mendapatkan maklum balas daripada peleajar yang mengikuti kursus Electrical Technology DET10013

Semua Jawapan yang diberikanakan disimpan secara sulit dan hanya akan digunakan untuk tujuan akademik Sahaja. Kerja sama yang telah diberikan ke atas kajian ini amatlah kami hargai.

BAHAGIAN A : Profil Demografi Responden. Tandakan (/) pada jawapan anda.

1. Umur:

•[ ] Kurang dari 18 tahun
•[ ] 18-24 tahun
•[ ] 25-34 tahun
•[ ] 35-44 tahun
•[ ] 45-54 tahun
•[ ] 55 tahun ke atas

2. Jantina:

•[ ] Lelaki
•[ ] Perempuan

3.Status Pendidikan:

•[ ] Sekolah Menengah
•[ ] Diploma
•[ ] Ijazah Sarjana Muda (Bachelor's Degree)
•[ ] Ijazah Sarjana (Master's Degree)
•[ ] Ijazah Doktor Falsafah (Ph.D)
•[ ] Lain-lain (silakan nyatakan)

4. Pekerjaan:

•[ ] Pelajar
•[ ] Pensyarah
•[ ] Guru
•[ ] Profesional / Pekerjaan Pejabat

5.Adakah anda mempunyai pengalaman sebelum ini dalam bidang Thevenin dan Norton Theorem atau analisis litar elektrik?

•[ ] Ya

•[ ] Tidak

6.Adakah anda seorang guru atau pelatih dalam bidang elektrik atau elektronik?

•[ ] Ya

•[ ] Tidak

7.Adakah anda mempunyai pengalaman dalam menggunakan peralatan atau Trainer serupa sebelum ini?

•[ ] Ya

•[ ] Tidak

BAHAGIAN B : KREATIVITI

Tandakan (/) pada jawapan anda berdasarkan skala 1, 2, 3, 4 dan 5.

Skor Nilai	Skor
Amat Tidak Bersetuju	1
Tidak Bersetuju	2
Tidak Pasti	3
Sangat Setuju	4
Amat Sangat Setuju	5

Bil	Item	1	2	3	4	5
1	Sila nyatakan tahap pemahaman anda mengenai konsep Thevenin dan Norton sebelum menggunakan Trainer ini.					
2	Adakah penggunaan Trainer Thevenin dan Norton Theorem membantu meningkatkan pemahaman anda terhadap konsep Thevenin dan Norton?					
3	Adakah Trainer ini membolehkan anda mengaplikasikan teori Thevenin dan Norton dengan lebih yakin dalam analisis litar elektrik?					
4	Adakah Trainer Thevenin dan Norton Theorem memberi anda pengalaman simulasi litar yang realistik?					
5	Adakah Trainer ini membantu meningkatkan kemahiran praktikal anda dalam menganalisis litar elektrik?					
6	Adakah Trainer ini memberi manfaat yang signifikan kepada proses pembelajaran atau kerja anda dalam bidang elektrik atau elektronik?					

Adakah anda mempunyai cadangan untuk memperbaiki atau memperluaskan ciri-ciri Trainer Thevenin dan Norton Theorem bagi meningkatkan keberkesanannya?

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BAHAGIAN C : MINAT

Bil	Item	1	2	3	4	5
1	Sejauh mana antara muka Trainer Thevenin dan Norton Theorem mudah untuk difahami dan digunakan?					
2	Adakah penggunaan dan penerokaan fungsi-fungsi di dalam Trainer adalah jelas dan tidak rumit?					
3	Adakah Trainer ini menyediakan arahan atau panduan yang mencukupi untuk membantu anda memahami cara menggunakan alat ini?					
4	Adakah anda bersetuju bahawa Trainer Thevenin dan Norton Theorem adalah mesra pengguna, iaitu dapat diakses dan digunakan tanpa banyak masalah atau kesulitan?					

Adakah anda mempunyai sebarang cadangan untuk menambah atau memperbaiki ciri-ciri mesra pengguna Trainer Thevenin dan Norton Theorem?

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Terima kasih atas kerjasama anda dalam mengisi soal selidik ini. Pandangan dan pengalaman anda adalah penting bagi kami untuk terus memperbaiki dan meningkatkan Trainer Thevenin dan Norton Theorem.

THANK YOU VERY MUCH!

By: Hamadi & Norliza