Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

ETEEF302

ELECTRONICS FUNDAMENTALS

APPLY ELECTRONICS FUNDAMENTALS

Competence

RQF Level: 3

Learning Hours 120

Credits: 12

Sector: Technical Services

Trade: Electronics and Telecommunication

Module Type: General

Curriculum: TSVETE3001 - TVET Level 3 in Electronics and Telecommunication

Issue Date: April 2022

Purpose statement	This module describes the knowledge and skills required to use electronics components. At the end of this module, the trainees will be able to describe and use passive components, active components and implement various electronic circuits using the mentioned active devices. In addition, the learners will identify and use different electronic workshop equipment, different simulation software and finally design and implement printed circuit boards using appropriate software.					
Learning assumed to be in place	N/A					
Delivery modality	**Training delivery**		**100%**	**Assessment**		**Total 100%**
	Theoretical content		30%	Formative assessment	30%	100%
	Practical work:		70%		70%	
	• Group project and presentation	20%				
	• Individual project /Work	50%				

Elements Performance Criteria	
Elements of competence	**Performance criteria**
1. Apply passive components	1.1. Passive components are clearly described in accordance with their types and features
	1.2. Passive components are properly measured respecting measuring techniques
	1.3. Passive components circuits are properly implemented according to their types and applications
2. Apply Active components	2.1. Active components are clearly described in accordance with their types and features, and working principle
	2.2. Active components are properly tested based on their testing techniques
	2.3. Analog Integrated Circuits are properly described according to their types and applications
	2.4. Active components circuits are properly implemented according to their applications
3. Use electronic lab/workshop equipment	3.1. Electronic lab/workshop equipment are identified according to their functions
	3.2. Electronic lab/workshop equipment are adequately operated according to the their functions
	3.3. Electronic lab/workshop equipment are properly tested according to their features
4. Use electronic circuit simulation software	4.1. Electronic symbols are appropriately identified according to the standards
	4.2. Electronic circuits simulation (ECS) software are properly identified according to their types and uses
	4.3. ECS software graphic interface is correctly described according to its settings

	functions.
	4.4. Circuits diagrams are accurately designed considering the given tasks
	4.5. 4.5. Circuits diagrams are successfully simulated considering the given tasks
5. Perform PCB design and implementation	5.1. PCB design software are properly identified according to their operation
	5.2. PCB design steps are completely executed respecting their process
	5.3. PCB is accurately printed according to the designed diagram.

Course content

Learning outcomes	**At the end of the module the learner will be able to:** 1. Apply passive components 2. Apply Active components 3. Use electronic lab/workshop equipment 4. Use electronic circuit simulation software 5. Perform PCB design and implementation
Learning outcome 1: Apply passive components	**Learning hours: 20**

Indicative content

- **Introduction to electronics components**
- **Description of resistors**
  - ✓ The types of resistors
  - ✓ Measuring resistance
  - ✓ Resistance Colour coding
  - ✓ Calculation of resistance in series, parallel and mixed connection
- **Description of capacitors**
  - ✓ The types of capacitors
  - ✓ Measuring capacitance
  - ✓ capacitance colour coding
  - ✓ Calculation of capacitance in series, parallel and mixed connection
- **Description of inductors**
  - ✓ The types of inductors
  - ✓ Inductance colour coding
  - ✓ Calculation of inductance in series, parallel and mixed connection

Resources required for the learning outcome

Equipment	Multimeter, oscilloscope, power supply, function generator, Computer, projector

Materials	Resistors, wires
Tools	Breadboard or PCB, soldering iron, desoldering pump, toolbox set
Facilitation techniques	• Lecture • Demonstration and simulation • Individual and group work • Trainer guided • Practical exercise
Formative assessment methods	• Written assessment • Group work activities • Oral presentation • Project based assessment

Learning outcome 2: Apply Active components	Learning hours: 45

Indicative content

- **Introduction to semiconductor devices**
- **Description of diodes**
  - ✓ Working principle of diodes
  - ✓ The types of diodes
  - ✓ Applications of diodes: rectification, Lighting, photo detection, voltage multiplier
- **Description of transistors**
  - ✓ Working principle of transistors
  - ✓ The types of transistors
  - ✓ Applications of transistors: switching and amplification
- **Description of thyristors**
  - ✓ Working principle of thyristors
  - ✓ The types of thyristors:
- **Description of optoelectronic components**
  - ✓ Working principle of optoelectronic components
  - ✓ The types of optoelectronic components
  - ✓ Applications of optoelectronic components
- **Description of integrated circuits (IC)**
  - ✓ Working principle of IC
  - ✓ The types of integrated circuits
  - ✓ Packaging of integrated circuits
  - ✓ Applications of integrated circuits

Resources required for the indicative content

Equipment	Multimeter, oscilloscope, power supply, function generator, Computer, projector
Materials	Diodes, transistors, thyristors, optoelectronic components, integrated circuits
Tools	Breadboard or PCB, soldering iron, desoldering pump, toolbox set
Facilitation techniques	• Lecture • Demonstration and simulation • Individual and group work • Trainer guided • Practical exercise / Experiments based exercises
Formative assessment methods	• Written assessment • Experiments assessment • Group work activities • Oral presentation • Project based assessment

	• Product based assessment

Learning outcome 3: Use electronic lab/ workshop equipment	Learning hours: 10
Indicative content	
• **Introduction to electronic workshop** • **Description of different electronic lab/ workshop equipment** ✓ Multi-meter, oscilloscope, function generator, soldering station, and AC/DC power supply • **Usage of different electronic lab/ workshop equipment** ✓ Multi-meter, oscilloscope, function generator, soldering station, and AC/DC power supply	
Resources required for the indicative content	
Equipment	Multimeter, oscilloscope, power supply, function generator, Computer, projector, soldering station,
Materials	Electronic components, jumper wires, probes, breadboard, soldering wires
Tools	Soldering iron, pliers, screwdrivers
Facilitation techniques	• Lectures • Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Project based assessment

Learning outcome 4: Use electronic circuit simulation software	Learning hours: 20

Indicative content

- **Introduction to electronic symbols**
- **Identification of electronic symbols**
  - ✓ Symbols of basic electronic components, power sources, wiring, inputs and loads
- **Identification of electronic simulation software**
  - ✓ Types of simulation software
- **Description of electronic simulation software environment**
  - ✓ Description of simulation software (features)
- **Designing circuits diagrams in electronic simulation software**
  - ✓ Using simulation software: Multisim, Proteus

Resources required for the indicative content

Equipment	Computer, projector
Materials	Various cables,
Tools	Simulation software, flash disk, memory card
Facilitation techniques	• Lectures • Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group activities
Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Product based assessment • Project based assessment

Learning outcome 5: Perform PCB design and implementation	Learning hours: 25
Indicative content	
• **Introduction to printed circuit board (PCB)** • **Identification of PCB design software** ➢ Types of software used to design a printed circuit board (PCB) • **Execution of PCB design in software** ✓ Make a PCB design Step by step • **Printing PCB design** ✓ Printing the PCB design	
Resources required for the indicative content	
Equipment	Computer, PCB printer, projector
Materials	Printing raw materials
Tools	PCB Software
Facilitation techniques	• Lectures • Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Product based assessment • Project based assessment

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