ANALOGUE ELECTRONICS I

UNIT CODE: 0714441 10A

TVET CDACC UNIT CODE: ENG/CU/MDE/CC/07/5/MA

UNIT DURATION: 80 Hours

UNIT DESCRIPTION

This unit describes the competencies required to apply analogue electronics. It involves applying semiconductor theory, semiconductor diodes, understanding of transistors, special semiconductor devices and performing rectification.

Summary of Learning Outcomes

	Learning Outcome	**Duration in hours.**
1.	To understand semiconductor theory	20
2.	To apply semiconductor diodes	20
3.	To apply transistors	20
4.	To apply special semiconductor devices	10
5.	To perform rectification	10
	TOTAL	**80**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	**Content**	**Suggested Assessment Methods**
1. Understand semiconductor theory	1.1 Atomic structure 1.1.1. Structure of the Atom 1.1.2. Electron Configuration 1.1.3. Ions and Charge Carriers 1.2 Types of materials 1.2.1. Insulators	• Practical Assessment • Project • Third Party Report • Portfolio of

Learning Outcome	Content	Suggested Assessment Methods
	1.2.2. Conductors 1.2.3. Semiconductors 1.2.4. Semiconductor materials 1.3 Types of semiconductors materials 1.3.1. Intrinsic semiconductors 1.3.2. Extrinsic semiconductors 1.3.2.1. n-type extrinsic semiconductor 1.3.2.2. p-type extrinsic semiconductor 1.4 The pn junction 1.4.1. Properties of pn junction 1.4.2. Current flow in a forward biased pn junction 1.4.3. Current flow in a reverse biased pn junction 1.4.4. V-I characteristics of a pn junction	Evidence • Written Assessment • Oral Questioning
2. Apply semiconductor diodes.	2.1 Introduction to the crystal diode 2.2 Characteristics of the crystal diode 2.2.1. Resistance of a crystal diode 2.2.2. Equivalent circuit of the crystal diode 2.3 Biasing of the crystal diode 2.3.1 Foreward biasing 2.3.2 Reverse biasing 2.4 Limitations in the operating conditions of a crystal diode 2.4.1 forward current rating	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral

Learning Outcome	Content	Suggested Assessment Methods
	2.4.2 PIV 2.4.3 power rating 2.5 Special purpose diodes 2.5.1 LED 2.5.2 Photodiode 2.5.3 Optoisolator 2.5.4 Tunnel diode 2.5.5 Varactor diode 2.5.6 Schockley diode 2.6 Application of semiconductor diodes	Questioning
3. Apply transistors.	3.1 Bipolar junction transistors (BJTs) 3.1.1 Types and construction of BJT transistors 3.1.2 Operation of NPN and PNP transistors 3.1.3 Charactristics of BJTs, i.e., V-I, and gain 3.2 BJT configurations 3.2.1 Common emitter 3.2.2 Common base 3.2.3 Common collector 3.3 Characteristics of BJT connections 3.4 BJT transistor load line analysis 3.4.1 DC load line 3.4.2 AC load line 3.5 BJT transistor biasing methods 3.5.1 Key terms in transistor biasing (faithful amplification, variation of transistor parameters,	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning

Learning Outcome	Content	Suggested Assessment Methods
	stabilisation) 3.5.2 Base resistor, emitter bias, collector feedback, voltage divider biasing techniques 3.6 Field Effect Transistors (FETs) – JFET & MOSFET 3.7 P and N channels of FETs 3.8 Operation of FETs 3.9 Characteristics of FETs 3.10 Biasing techniques of FETs 3.11 Application of FETs	
4. Apply special semiconductor devices.	4.1 Special semiconductor devices 4.1.1 SCR 4.1.2 LASCR 4.1.3 TRIAC 4.1.4 DIAC 4.1.5 SCS 4.1.6 UJT 4.2 Operation principle of special semiconductor devices 4.3 Schematic symbols of special semiconductor devices 4.4 Application of special semiconductor devices	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning
5. Perform rectification.	5.1 Types of rectifiers 5.1.1 Half wave rectifiers 5.1.2 Full wave rectifiers (center-tap and bridge) 5.2 Classes of rectifiers	• Practical Assessment • Project • Third Party Report

Learning Outcome	Content	Suggested Assessment Methods
	5.2.1 Uncontrolled Rectifier 5.2.2 Controlled Rectifier 5.2.3 Half-Controlled Rectifier 5.2.4 Fully-Controlled Rectifier 5.3 Application of rectifiers 5.4 Types of converters 5.4.1 AC to DC converter (rectifier) 5.4.2 DC to AC Converter (Inverter) 5.4.3 DC to DC Converter 5.4.4 AC to AC Converter 5.5 Application of converters	• Portfolio of Evidence • Written Assessment • Oral Questioning

Suggested Methods of Instruction

- Practical
- Projects
- Demonstrations
- Group discussions
- Interactive lectures
- Industrial attachment
- Viewing of related videos

S No.	Category Item	Description Specifications	Quantity	Recommended Ratio (Item: Trainee)
A	**Learning Materials**			

1.	Reference books	Mehta, V. K., & Mehta, R. (2020). Principles of electronics (12 edition). S. Chand and Company Limited, Theraja, B. L., & Theraja, A. K. (2005). A textbook of electrical technology (1st multicolour ed., Multicolour illustrative ed., 23rd rev. multicoloured ed). S. Chand & Co. Bird, J. O. (2022). Bird's electrical and electronic principles and technology (Seventh edition). Routledge, Taylor & Francis Group.	10 pcs for each book	1:2.5
2.	Software	Assorted simulation software e.g., Circuit wizard.	25	1:1
3.	Audio visual presentations	Projector	1	1:25
B	**Learning Facilities & infrastructure**			
4.	Lecture theory room	$60m^2$	1	1:25
5.	Workshop	$150m^2$	1	1:25
6.	Computer laboratory	$100m^2$	1	1:25
C	**Consumable materials**			
7.	Electronic components	Breadboards, Stripboards, Jumper wires, Assorted	25 pcs	1:1

		resistors, Assorted capacitors, Assorted MOSFETs, Assorted JFETs, 555 timers, Solder wire, LEDs, Assorted BJT transistors, LDRs, OPAMPs, thermistors, 12V DC motors		
D	**Tools and Equipment**			
8.	Assorted tools and equipment	Side cutters, Side cutters, Pliers, Screw driver, Crimping tools, Mult-meter, Solder guns	25 pcs	1:1
9.	Assorted electrical gadgets	Solder gun, Heat sink, Hot air guns, function generator	25 pcs	1:1
10.	Assorted measuring instruments	Digital Oscilloscope,	5 for each category	1:5
11.	Digital Multimeter,			
12.	Digital functional generator		3 pcs	1:8
13.	Laser jet printer		2 pcs	1:13
14.	Power supply	Variable power supply, 5V Power adapters, 9V Power adapters, 12V Power adapters.	10 pcs	1:3
15.	Trainers kit	Analogue training kits, PWM kit	5 pcs	1:5
16.	PCB prototyping material	Copper board, ferrite chloride solution, see-through printing paper, HASL finishing PCB	25 for each category	1:1
17.	Drilling gun		3 pcs	1:8
18.	Work stations		25	1:1