

HLUVUKANIe LABs

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING TRAINING (DEEET)

SCHOOL OF SOLAR ENERGY

STUDY GUIDE FOR

COURSE: Basic Analog and Digital Electronics COURSE CODE: ADE01 COURSE DURATION: One day COURSE CREDITS: 0.5

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TABLE OF CONTENTS

INDEX		
1.	INTRODUCTION	3
2.	GENERAL INFORMATION	3
3.	POGRAMME DEFINITION	4
4.	GENERIC ENGINEERING STANDARDS	4
5.	UNITS OF LEARNING	5
6.	ASSESMENT DETAILS	5

1. INTRODUCTION

Welcome to the Short Learning Program (SLP) for "Basic Analog and Digital Electronics". This short course is aimed to enhance your fundamental knowledge in the principles of electronic circuits. The candidates are required to have a minimum knowledge of algebra and electricity that is covered in grade nine. The course will not dwell onto basic principles of electricity such as conduction, potential difference, charges, currents, etc. In the course students will explore various simulated and physical analog and digital circuits. The course forms the foundation of microcontroller's course that will be offered on due course. The microcontrollers course, together with this course are combined to give a credit of 2.

Electronics evolution

Electronics started more than a century ago. It went through quite some stages within this rather short period. It started in the 20ties of the 19th century when RADIO TECHNOLOGY was born. The first challenge was to produce more sound for the listener, and this made it necessary to invent VALVES. During the 30 ties there was the challenge to handle higher frequencies, and when this goal was achieved, it was possible to think of trials with RADAR and TELEVISION. In the 40ties the first experiments with so called "ELECTRONIC BRAINS" (later they were called COMPUTERS) were carried out. At the end of the 40ties - just after the second world war - the SEMICONDUCTORS were more closely researched and led to the inventing of DIODES and TRANSISTORS. Those new components were very helpful in building much smaller computers which were very important for the first travels to space. Now the field of application of electronic equipment grew very fast. On other very important step connected with this field of technology was the change of method to manufacture the circuits:

- while in the first radios the circuit had been WIRED like all the devices

- later on it was found more economical (because it was much faster and possible with much less faults) to wire it by so called PRINTED CIRCUITS (Insulating boards with copper lines on it, which represent the wires, and which can be "printed" on the boards)

- the next step was to find a way to "engrave" whole circuits on a very small piece of semiconducting material. Such circuits were called then "INTEGRATED CIRCUITS" - they can hold nowadays thousands of transistors

2. GENERAL INFORMATION

This course will be provided in a form of workshop, no certificate will be issued.

Queries related to this course may be directed via WhatsApp or physical call.

Your instructor is Dr. Nkateko E Mabunda, Cellphone no: +2784 535 3108

3. PROGRAMMEME DEFINITION

SLP NAME	:	Basic Analog and Digital Electronics
CODE	:	ADE01
NQF LEVEL	:	NIL
MODULE PRE-REQUISITE	:	Grade 9 Mathematics and Science
MODULE DURATION	:	8 HOURS
MODULE RANGE	JLE RANGE : The course will enhance the knowledge and skills candidates in analog and digital circuits operation principles.	
PRE-KNOWLEDGE:	:	The learner is expected to possess a prior knowledge in basic algebra and electricity.
TEACHING AND LEARNING STRATEGIES	:	The program is presented as a workshop. Certificate of attendance will only be issued after completion of Microcontrollers course, that follows it. Student will demonstrate their competency by successfully completing the given practical assignment tasks.
		Books : Notes Electronics Fundamentals E E Glasspoole Digital Fundamentals by Floyd Digital Systems 1 by J. Van B. Beukes

4. GENERIC ENGINEERING STANDARDS

The following standards will be used in the presentation of this module:

- Proven Engineering philosophies, principles, processes, procedures and practices
- Industrial norms and standards and manufacturer specifications
- SABS Quality standards and parameters
- Occupational Health and Safety Act
- Quality assurance norms as established by HEQC and internal university assurance policies
- Quality assurance norms as established by The Engineering Council of South Africa (ECSA)

Please adhere to all covid-19 regulations

5. UNITS OF LEARNING

Unit (duration)	Reference	
Analog electronics	On completion of this unit, the candidate will be	Notes
components (1 hour).	able to:	
	 Present circuit symbols for different types of analog electronics components, describe their functionality and give examples of their applications. 	
Analog electronics	On completion of this unit, the candidate will be	Notes
circuits (3 hours).	able to:	E E Glasspoole
	 Build and analyze a simple ac to DC converter, built and analyze transistor switch and evaluate selected elementary electronics circuits. 	
Digital electronics	On completion of this unit, the candidate will be	Notes
notations and logic	able to: • convert integers between binary and	
systems (1 hour).	decimal notations.	
	 Present circuit symbols for different types of digital electronics gates, describe their functionality and give examples of their applications. 	
Digital electronics circuit	On completion of this unit, the candidate will be	
systems (3 hours).	 able to: understand the significance of Karnaugh Maps and Combine logic gates to produce a desired system outcome 	

6. ASSESMENT DETAILS

Use NAND gates to implement the traffic lights controller which will operates on a four way intersection where all roads carries traffic towards both directions (two way). The operation should be as follows:

 \Box Four set of infra-red sensors situated in all directions i.e., North, East, West, and South are found 100 m from the intersection. Place fours switches on a bread board to simulate these sensors.

 \Box Sensors gives an active one(1) output when cars are detected and zero (0) when no cars are detected.

 \Box The North and South lights are green when all sensor outputs are the same or at least one of the sensors for this direction is active.

 \Box The East and West lights can only be green provided that both the North and South sensor outputs are 0 whilst at least one of the East and West sensors is active.

□ All lights are switched by NAND gate circuit to either green or red. Use green and red LEDs.

1.1 Give a truth table. (6)

1.2 Give simplified Karnaugh maps. (6)

1.3 Sketch properly labeled circuits. (6)

1.4 Build a neat circuit on a bread board. (6)

1.5 Test your circuit (6)

No formal assessment will be carried out