higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

NOVEMBER EXAMINATION

LOGIC SYSTEMS N6

19 NOVEMBER 2014

This marking guideline consists of 9 pages.

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QUESTION 1

1.1 LISTING THE PROGRAMMING LANGUAGES DEFINED BY THE INTERNATIONAL ELECTROTECHNICAL COMMISSION UNDER OPEN INTERNATIONAL STANDARD IEC 61131-3. (FORMAT: TEXT OR GRAPHICAL) ✓

(1) LADDER DIAGRAM (GRAPHICAL) ✓✓
(2) FUNCTION BLOCK DIAGRAM (GRAPHICAL) ✓✓
(3) STRUCTURED TEXT (TEXT) ✓✓
(4) INSTRUCTION LIST (TEXT) ✓✓
(5) SEQUENTIAL FUNCTION CHART (GRAPHICAL) ✓✓ (10)

1.2 The program segment below is shown in Instruction List (also commonly called 'Statement List'). The program allows MOTOR_1 to run for ten seconds (#100) before it is disconnected by TIMER_1. The values given in the VALUE column are (with the exception of the hexadecimal timer value) Boolean values (either 0 or 1). The values given in the table are the un-energised values before the circuit is switched on. ✓

RUNG	STEP	INSTRUCTION	OPERAND	VALUE	COMMENT
0	0	LD	**A**	0	PUSHBUTTON ON_SWITCH ✓ ✓
	1	OR	**Z**	0	MOTOR_1 (CONTACT) ✓
	2	ANDNOT	**T0001**	0	TIMER CONTACT ✓
	3	OUT	**Z**	0	MOTOR_1 ✓ ✓
1	4	LD	**Z**	0	MOTOR_1 (CONTACT) ✓
	5	TIM	**0001**	0100Hex	TIMER_1 ✓
			#100		

(10)
[20]

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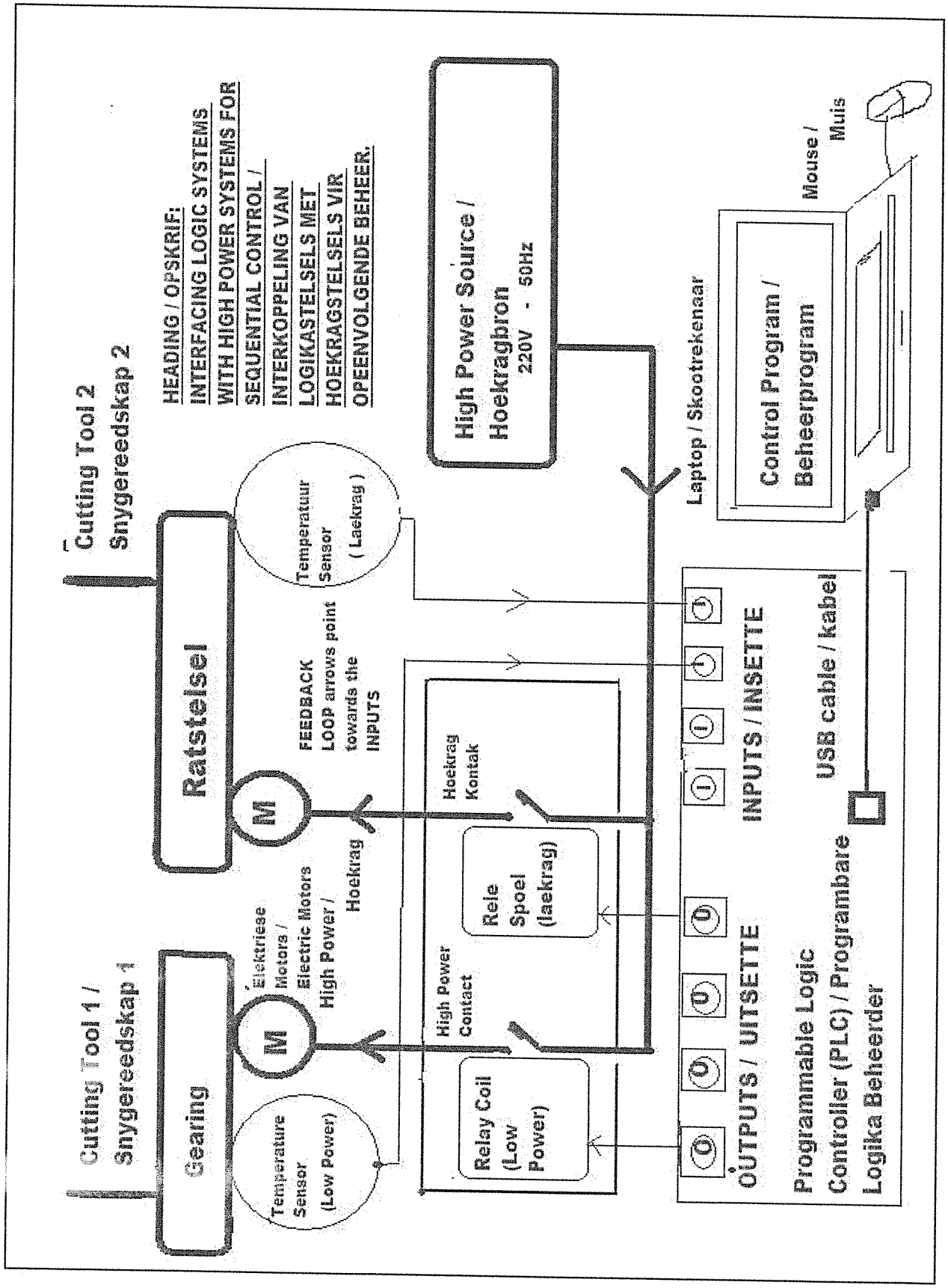
QUESTION 2

2.1



LOGIC SYSTEMS CONTROL OF TWO CUTTING TOOLS

(10)

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2.2
- The program must be freely distributed.
- Source Code must be included.
- Anyone is allowed to modify the source code.
- Modified versions can be redistributed.
- The license must not exclude or interfere with the use of other software. (5)

2.3 FIVE (OF EIGHT LISTED HERE) HIGH-LEVEL PROGRAMMING LANGUAGES:

(1) ANDROID
(2) COBOL
(3) VISUAL BASIC
(4) C; C+; C#
(5) JAVA
(6) PASCAL
(7) DELPHI
(8) FORTRAN (5)
[20]

QUESTION 3

3.1 False
ANDROID is a LINUX-based operating system for mobile devices such as smartphones and tablet computers. It is open source. Microsoft has no proprietary rights over ANDROID.

3.2 False
Microsoft's Office Suite is not Open Source software. You do not buy the source Code when you buy Microsoft Office. Microsoft owns the source code and they do not allow others to alter it.

3.3 False
The LINUX operating system was originated by Linus Torvalds in the early 1990s and has been developed on Open Source platforms since then.

3.4 False
READ reads RAM.

3.5 False
IR holds OP-CODE as well.

3.6 False
The PROGRAM COUNTER holds the address of the next instruction.

3.7 True
The Control Unit and access to memory and all CPU operations are synchronised by the system clock oscillator.

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3.8 True
Both machine code and assembler are non-portable.

3.9 True
The accumulator stores the output of the ALU.

3.10 True
If there is no JUMP instruction then the Program Counter will INCREMENT: PC + 1.

(10 x 2) **[20]**

QUESTION 4

4.1 BUILDING A DIGITAL MULTIMETER USING LARGE-SCALE INTEGRATION

The trend has been towards more and more integration around microprocessor functions (i.e. digital processing). Hybrid circuits use operational amplifiers (particularly for input functions). Despite the mix-and-match construction designs of the major manufacturers (which blur the classification somewhat) the following can be accepted as a guide to LSI-multimeter construction:

INPUT CIRCUITS
FUNCTIONS: Sensing Shunting Safety (Remember these as the 'three S's')

ANALOGUE construction designs and operational amplifiers are still sometimes used here.

Attenuation, Amplification and Filtering
Functions here are still sometimes op-amp based (i.e. ANALOGUE). SWITCHING FUNCTIONS from the microprocessor (Digital Logic Switching) activate these circuits. The resultant mix-and-match of digital and analogue functions are called HYBRID circuits. The trend is to extend the range of the microprocessor to take care of ALL these functions, using purely switching functions.

PROCESSING CIRCUITS
Processing circuits are based on a MICROPROCESSOR (digital logic designs). As the power of embedded (i.e. real-time) processing grows, more and more jobs (i.e. functions) are taken over by the microprocessor. This includes filtering, amplification and attenuation.

OUTPUT CIRCUITS
These today are digitally controlled by the user via choices offered by the microprocessor.

(8)

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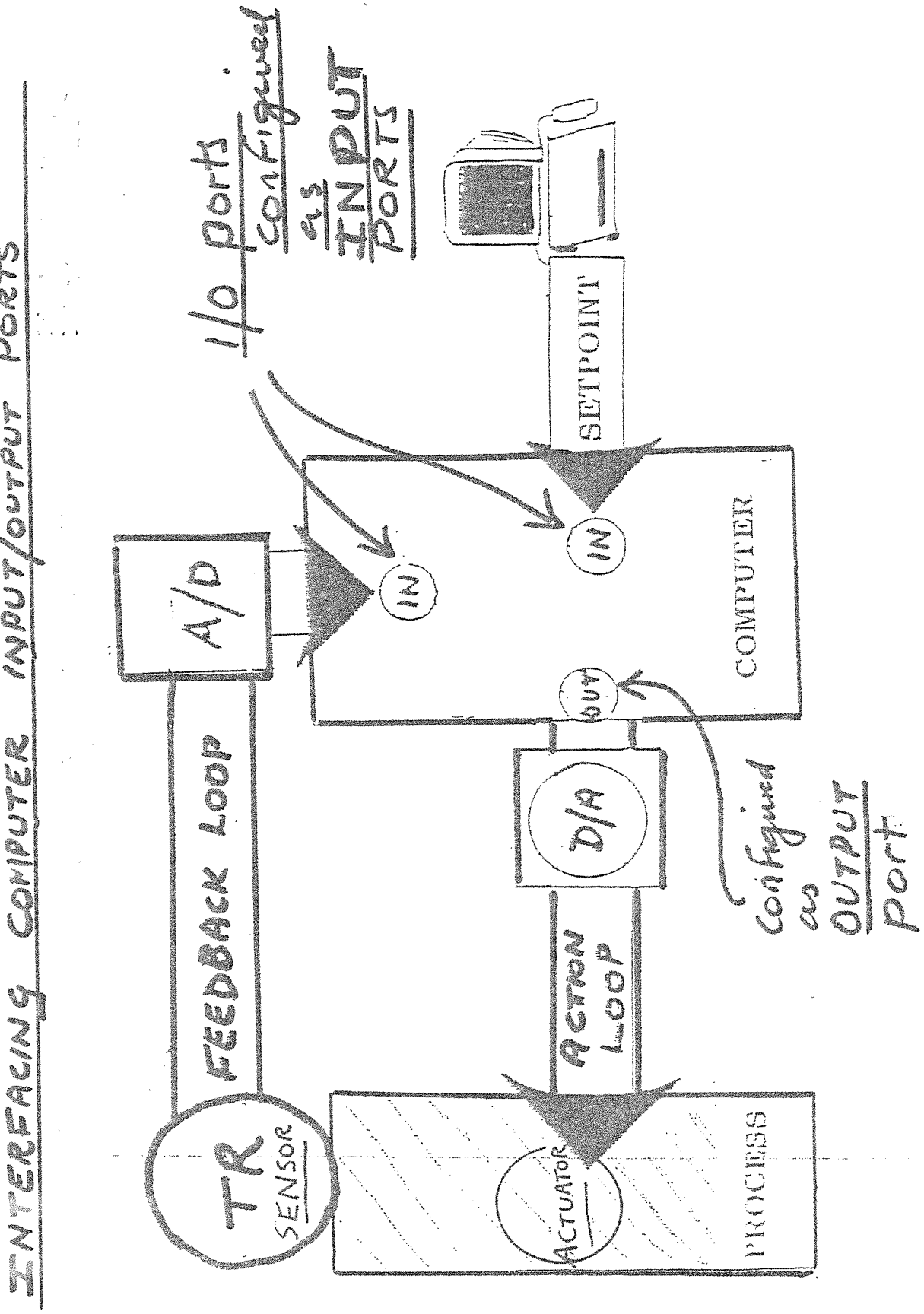
4.2


INTERFACING COMPUTER INPUT/OUTPUT PORTS
I/O ports configured as INPUT PORTS
SETPOINT
A/D
IN
IN
COMPUTER
OUT
D/A
Configured as OUTPUT port
FEEDBACK LOOP
ACTION LOOP
TR
SENSOR
ACTUATOR
PROCESS

✓ ✓ ✓ ✓ ✓ ✓ (6)

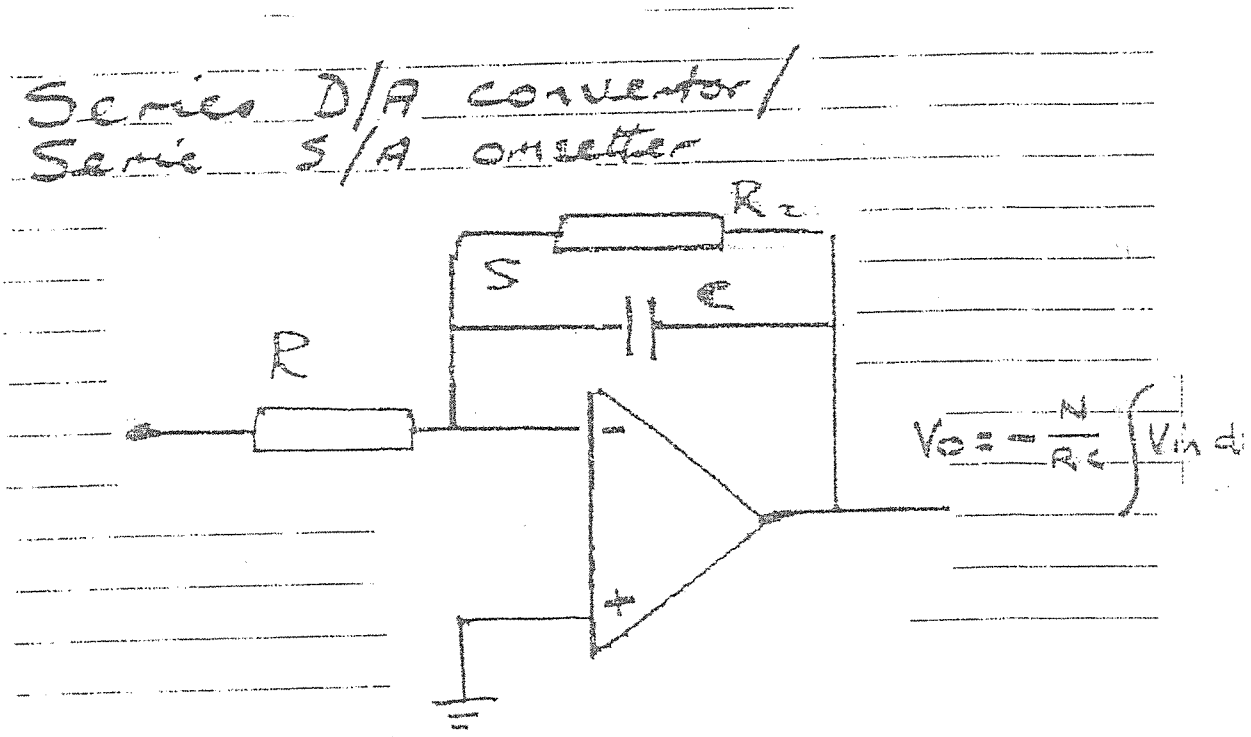
4.3 Mathematical operations done before coding:
$z = u\,(t + u)$
$z = u\,(u + t)$

INSTRUCTION ADDRESS	INSTRUCTION WORD		DESCRIPTION
	OP-CODE	ADDRESS	
AAA	LOAD	F1B4	Load u
AAAB	ADDA	F1B3	Add t
AAAC	BRAP	AAB1	Branch if Acc > 0
AAAD	MULT	F1B4	Multiply by u
AAAE	BRAP	AAB1	Branch if Acc > 0
AAAF	STOR	F1B9	Store in z
AAB0	OUTP		Output
AAB1	HALT		Halt
✓	✓	✓	✓ ✓

NOTE: Other programming sequences are accepted but you must clearly show what you are doing. (6)
[20]

QUESTION 5

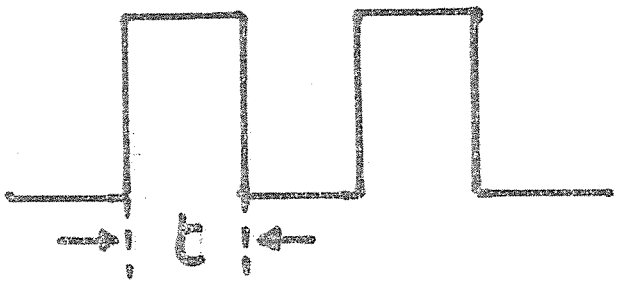
5.1 5.1.1 SERIES D/A CONVERTOR



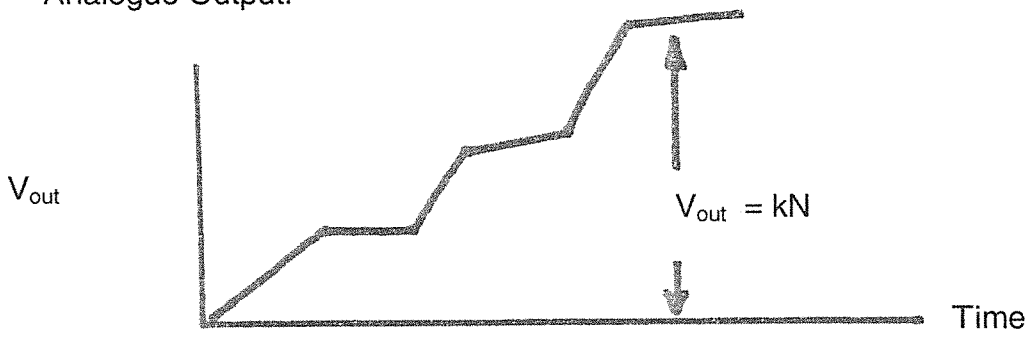
√ √ √ √ √ (5)

5.1.2 SERIES D/A CONVERTER:

DIGITAL INPUT:



Analogue Output:



Where k = constant
N = number of Marks

✓ ✓ (2)

5.1.3 PRINCIPLE OF OPERATION:

(a) The voltage in the mark-time of the pulse wave-form charges the capacitor. ✓

(b) The output voltage is proportional to N (the number of MARKS) ✓✓ (3)

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5.2 FIVE (of seven listed here) WELL-KNOWN OPEN-SOURCE PRODUCTS AND THEIR USES

(1) LINUX (Operating System) ✓✓
(2) APACHE (Web Server) ✓✓
(3) ANDROID (Operating System) ✓✓
(4) osCOMMERCE (e-commerce) ✓✓
(5) MOZILLA FIREFOX (internet browser) ✓✓
(6) PNG (Portable Network Graphics)
(7) ASTERISK (PBX – Private Branch Exchange)

(10)
[20]

TOTAL: 100

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