higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N6

31 JULY 2019

This marking guideline consists of 7 pages.

QUESTION 1: COMPUTER SYSTEMS

1.1
1.1.1 D
1.1.2 A
1.1.3 A
1.1.4 C

(4 × 1) (4)

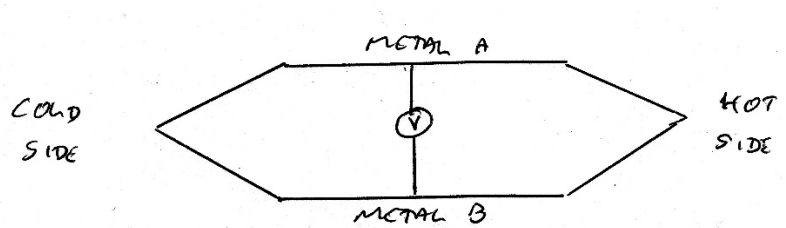
1.2
1.2.1 True
1.2.2 True
1.2.3 True
1.2.4 False

(4 × 1) (4)

1.3
1.3.1 D
1.3.2 F
1.3.3 C
1.3.4 B

(4 × 1) (4)

1.4



Follows the Seebeck effect which means if two different metals have their ends joined and those ends are kept at different temperatures, a potential difference that is proportional to the temperature difference develops across the metals (4)

1.5
- Data selection
- Data routing
- Operation sequencing
- Parallel-to-serial conversion
- Waveform generation
- Logic function generation

(Any 4 × 1) (4)

[20]

QUESTION 2: TRANSMISSION, DATA ACQUISTION AND RELATED HARDWARE

2.1 2.1.1 A
2.1.2 C
2.1.3 A
2.1.4 B

(4 × 1) (4)

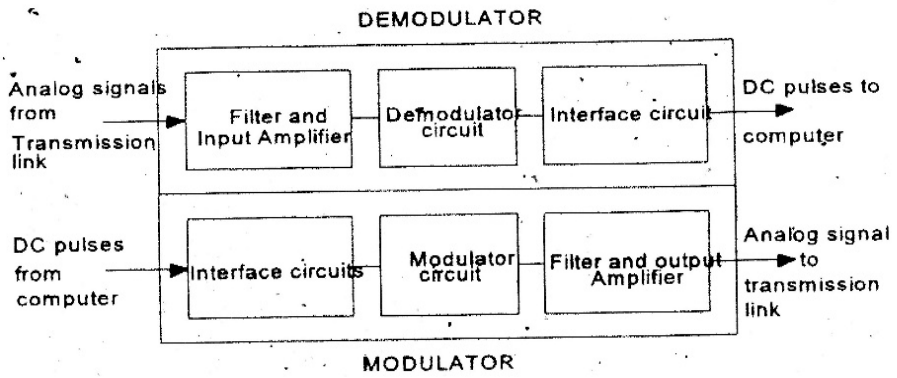
2.2 2.2.1 False
2.2.2 True
2.2.3 True
2.2.4 False

(4 × 1) (4)

2.3 2.3.1 E
2.3.2 C
2.3.3 B
2.3.4 A

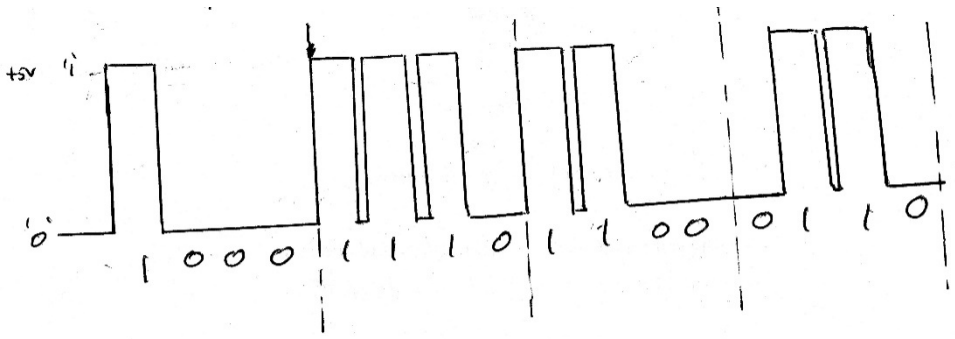
(4 × 1) (4)

2.4



(4)

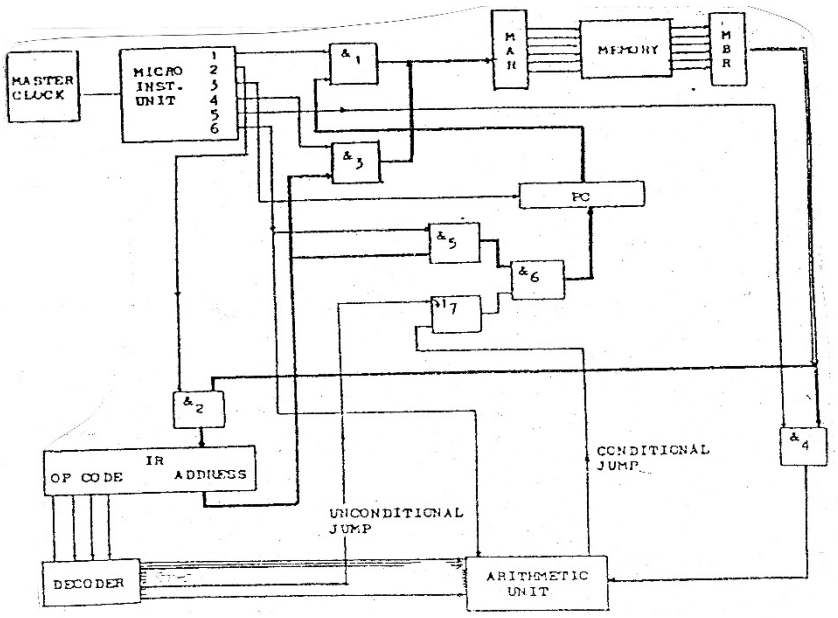
2.5



(4)
[20]

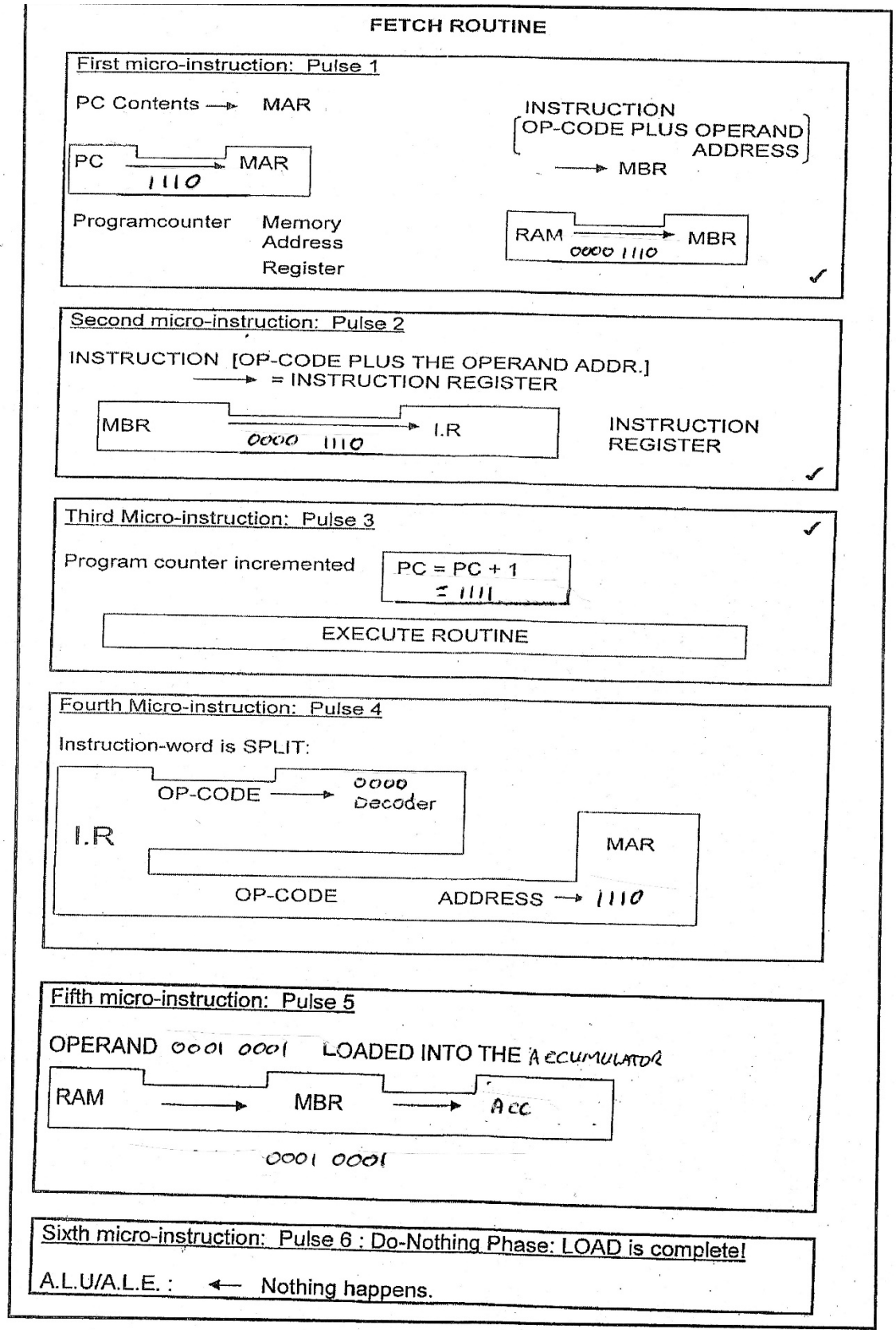
QUESTION 3: COMPUTER ARCHITECTURE

3.1



(10)

3.2


FETCH ROUTINE
First micro-instruction: Pulse 1
PC Contents → MAR
PC → MAR
1110
Programcounter
Memory Address Register
INSTRUCTION
OP-CODE PLUS OPERAND ADDRESS
→ MBR
RAM → MBR
0000 1110
Second micro-instruction: Pulse 2
INSTRUCTION [OP-CODE PLUS THE OPERAND ADDR.]
→ = INSTRUCTION REGISTER
MBR → I.R
0000 1110
INSTRUCTION REGISTER
Third Micro-instruction: Pulse 3
Program counter incremented
PC = PC + 1
= 1111
EXECUTE ROUTINE
Fourth Micro-instruction: Pulse 4
Instruction-word is SPLIT:
OP-CODE → 0000 Decoder
I.R
MAR
OP-CODE
ADDRESS → 1110
Fifth micro-instruction: Pulse 5
OPERAND 0001 0001 LOADED INTO THE ACCUMULATOR
RAM → MBR → Acc
0001 0001
Sixth micro-instruction: Pulse 6 : Do-Nothing Phase: LOAD is complete!
A.L.U/A.L.E. : ← Nothing happens.

(10)
[20]

QUESTION 4: HIGH-LEVEL PROGRAMMING

4.1

PASS	MUMFORD	SONS	ANSWER
0	14	9	23
		16	
- - - - -	- - - - -	- - - - -	- - - - -
1			30
		23	
- - - - -	- - - - -	- - - - -	- - - - -
2			37
		30	
- - - - -	- - - - -	- - - - -	- - - - -
3			44
		37	

(10)

NOTE: 1. The column PASS can start on 1 and not 0.

2. Each correct row (to the dashed line which does not have to be included) is worth TWO marks – no half marks. Mistakes must NOT be followed through.

3. The final printout below the table must be in the correct order for TWO marks.

4.2
- A bug is an unintentional fault in a program that causes malfunctioning.
- A virus is a program intentionally designed to cause trouble in a computer. (2)

4.3 Stack pointer
0A
Stack

Address	Contents
07	60_{16}
08	32_{16}
09	81_{16}
0A	$F2_{16}$

(3)

NOTE: ONE mark for incrementing the stack pointer, ONE for indicating the new address and ONE for including the new contents. If the candidate did not redraw the rest of the stack, only the mark for the correct stack pointer can be given.

4.4

INSTRUCTION NUMBER	ACCUMULATOR CONTENTS
00	33_{16}
01	77_{16}
02	FF_{16}
03	88_{16}
04	99_{16}

NOTE: The instruction number may also be given in binary. The accumulator contents must be given in hexadecimal. (5)

[20]

QUESTION 5: NUMBER SYSTEMS

5.1 $0_1\ 1_2\ 1_3\ 1_4\ 1_5\ 1_6\ 1_7\ 1_8\ 1_9\ 1_{10}$

Pos. 1 checks 3; 5; 7; 9
1 1 1 1 – P1 should thus be 0: IT IS thus: 0

Pos. 2 checks 3; 6; 7; 10
1 1 1 1 – P2 should thus be 0: NOT thus: 1

Pos. 4 checks 5; 6; 7
1 1 1 – P4 should thus be 1: IT IS thus: 0

Pos. 8 checks 9; 10
1 1 – P8 should thus be 0: NOT thus: 1

Thus the fault lies on bit $1010_2 – 10_{10}$

Thus pos.10 which is a 1 should be a 0

i.e. the word should be: **$0111111110_{hamming}$** (10)

5.2 $+0{,}01111010 \times 10^{+111}$

$= 111101_2$

$= 32 + 16 + 8 + 4 + 1$

$= 61_{10}$ (3)

5.3 **$1100\ 0101\ 1001_{XS3}$** (3)

NOTE: ONE mark for each nibble (4-bit string). If the subscript is omitted, the answer is wrong.

5.4 **1111010_2**

NOTE: ONE mark for the correct conversion, ONE for showing the subscript 2 (2)

5.5 $D.(E + F) = D.E + D.F$
$D + E.F = (D + E).(D + F)$ (2)
[20]

TOTAL: 100