



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N6

3 APRIL 2018

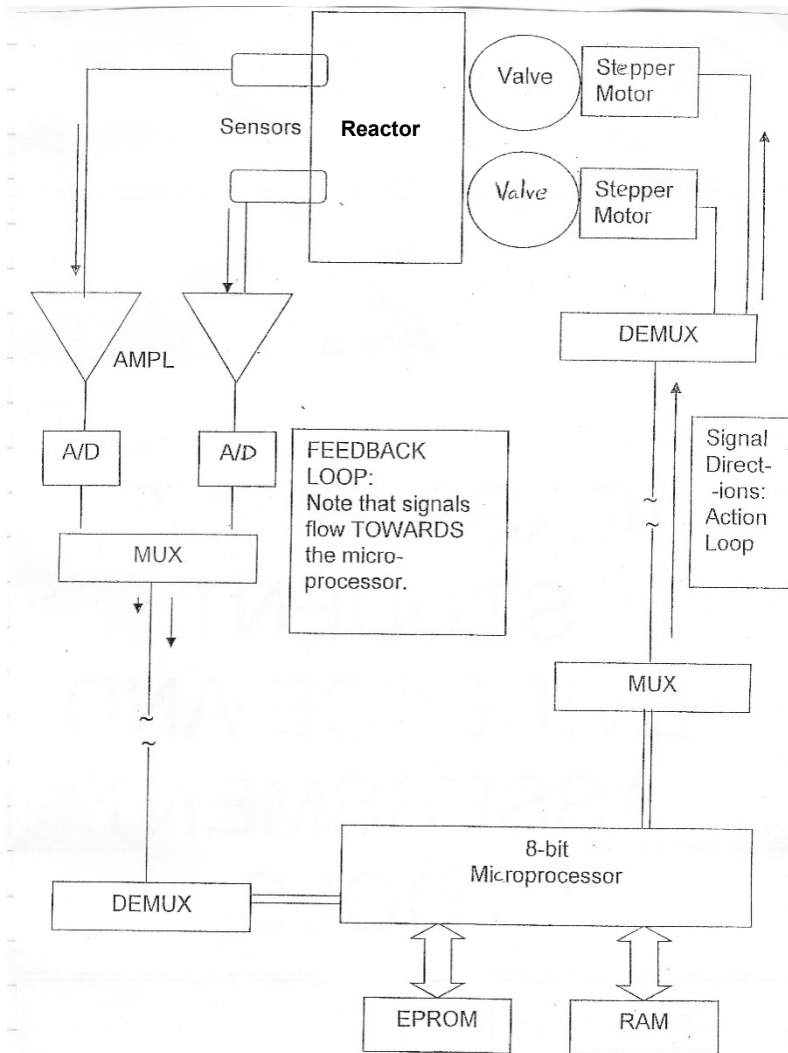
This marking guideline consists of 5 pages.

QUESTION 1: COMPUTER SYSTEMS

1.1 Thermocouple (1)

1.2 Action loop (1)

1.3



NOTE:

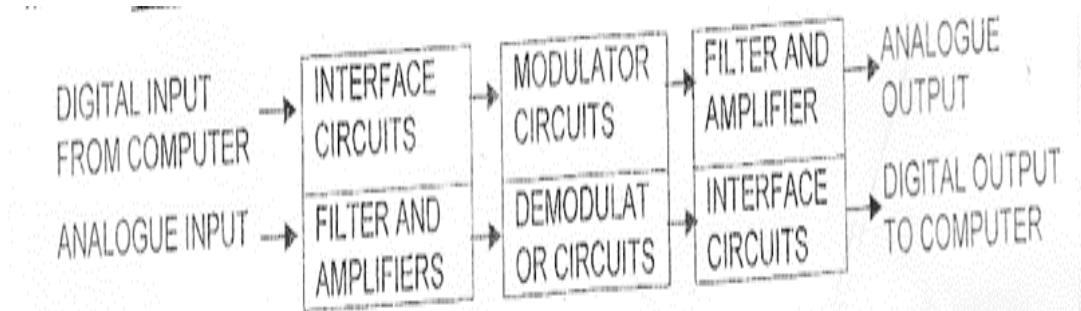
- A modem may be added on both loops on receive and send sides.
- The top block must be appropriately labelled, e.g. reactor.
- 'Sensors' can be labelled 'Transducers'.

(12)

- 1.4
- The cost of a new system or expansion of the existing system
 - Hiring of additional and specialised personnel
 - Training of personnel
 - Advantages and benefits that can be derived from the proposed system
 - Environmental considerations
 - Problem areas as well as possible solutions
 - Commissioning and installation
 - Service and back-up facilities
 - Data files and format requirements at both input and output terminals
 - Future expansion and estimated life-time of the system
- (Any 6 × 1) (6)
[20]

QUESTION 2: TRANSMISSION, DATA ACQUISITION AND RELATED HARDWARE

2.1

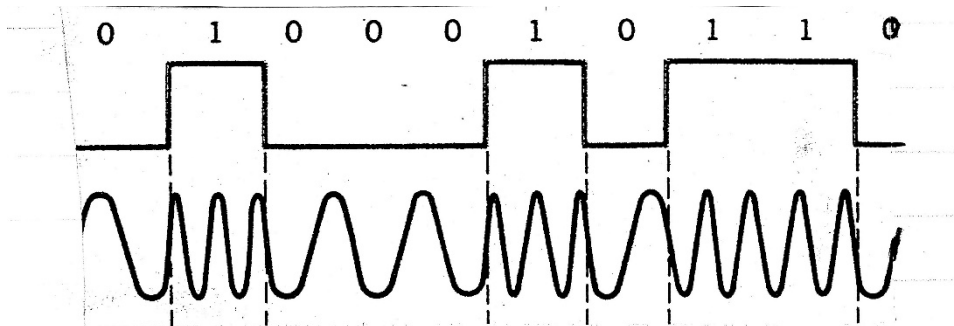


The modem converts digital data from the computer into frequency shifted keying (fsk) on the transmit side, and fsk back into digital data on the receive side.

NOTE: TWO marks for stating the function on transmit and receive (NO half marks – it's complete or it's wrong) and FOUR marks for the diagram.

(6)

2.2



A LOW FREQUENCY DESIGNATES A ZERO
A HIGHER FREQUENCY DESIGNATES A ONE

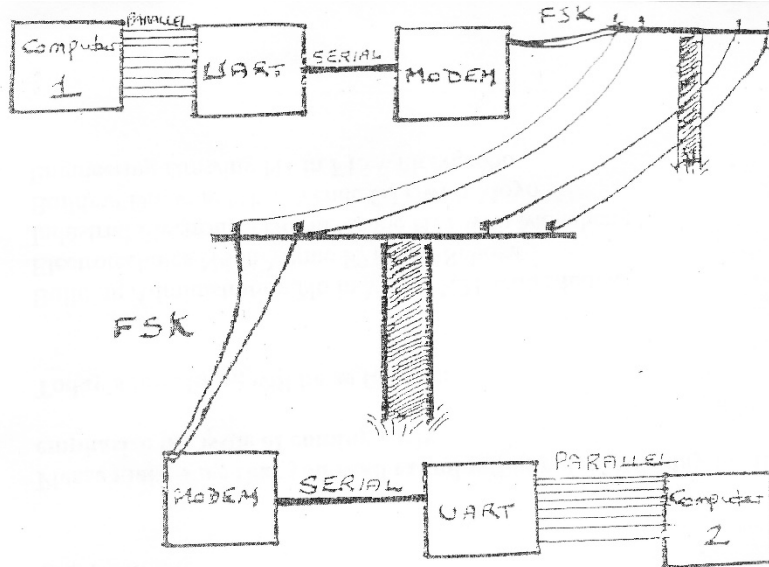
NOTE: Any wave train can be drawn as long as the frequencies on the '1' are visibly higher than the frequencies on the '0', and these frequencies must be a constant amplitude throughout.

(3)

- 2.3
- Data selection
 - Data routing
 - Operation sequencing
 - Parallel-to-serial conversion
 - Waveform generation
 - Logic function generation

(Any 4 × 1) (4)

2.4



NOTES:

- The telephone lines may be represented by a dotted or dashed line.
- Where the outputs are parallel, serial and in fsk format must be clearly indicated.

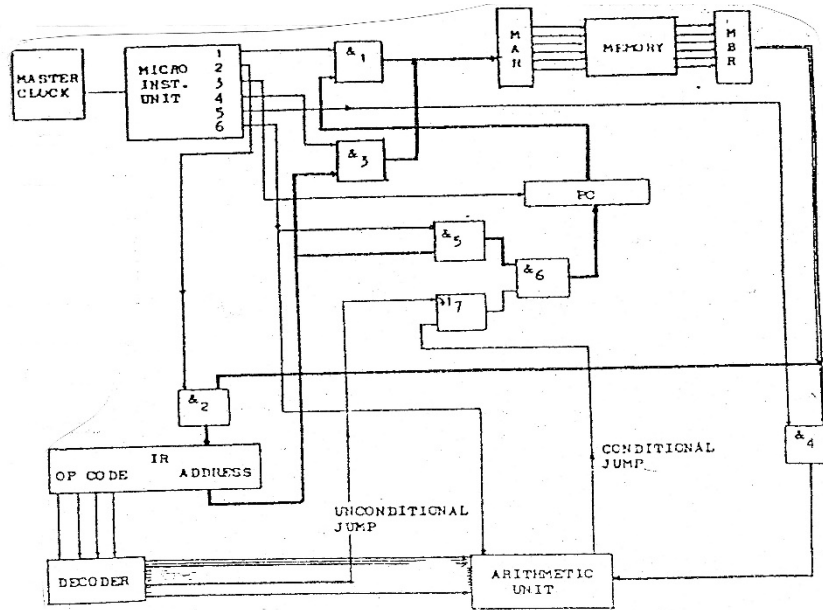
(6)

2.5 Universal Asynchronous Receiver-Transmitter

(1)
[20]

QUESTION 3: COMPUTER ARCHITECTURE

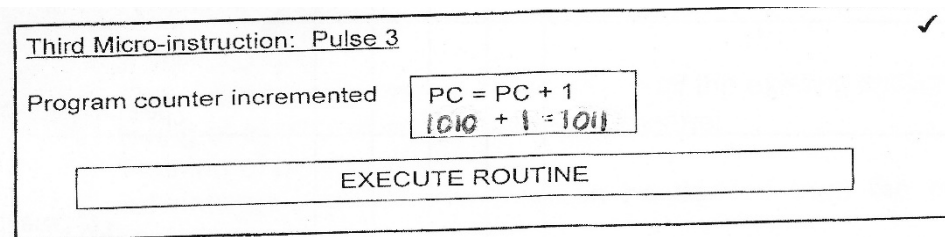
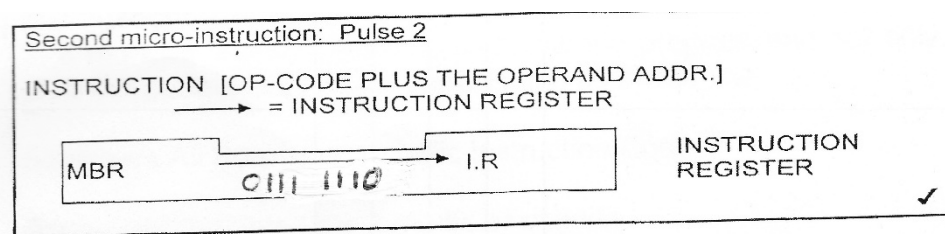
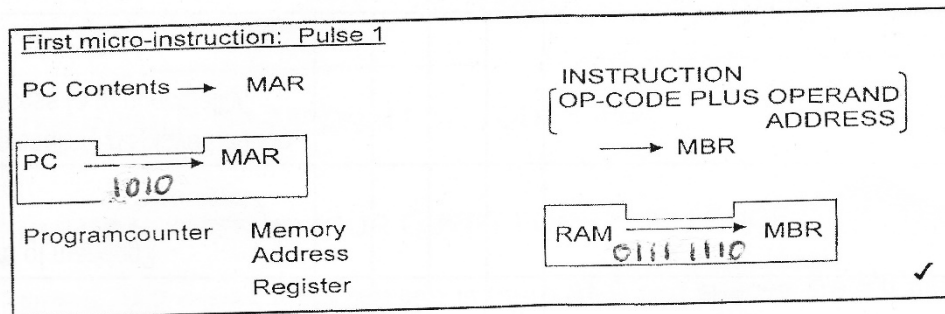
3.1

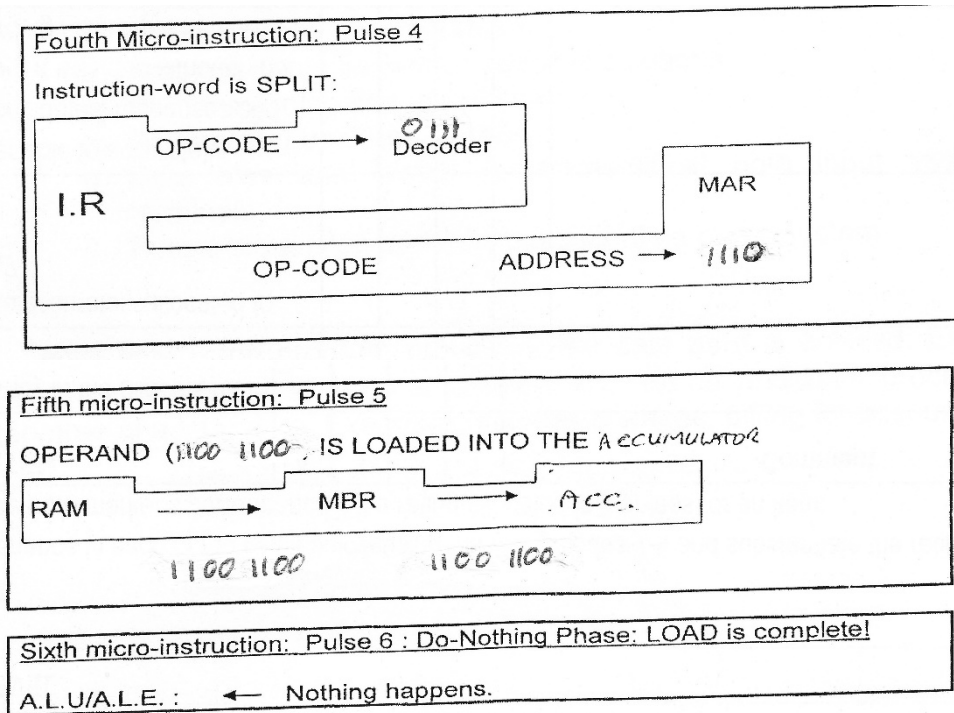


(10)

3.2

FETCH ROUTINE





(10)
[20]

QUESTION 4: HIGH-LEVEL PROGRAMMING

- 4.1
- Beginners All-Purpose Symbolic Instruction Code
 - Common Business Orientated Language

(2)

4.2

<u>PASS</u>	<u>IMAGE</u>	<u>TOOLBOX</u>	<u>ANSWER</u>
0	15	8	23
- - - - -	- - - - -	15	
1		22	30
- - - - -	- - - - -	29	
2		36	37
- - - - -	- - - - -		
3			44

44 15 36

NOTE:

- The column 'PASS' can start on 1 and not 0.
- 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.
- The final print-out below the table MUST be in the correct order for TWO marks.

(10)

4.3		SPEED	DE-BUGGING	
	COMPILED	Fast	Difficult to de-bug	
	TRANSLATED	Slow	Easy to de-bug	(4)

- 4.4
- A bug is an unintentional fault in a program that causes the program not to work as it should.
 - A virus is a program designed to cause trouble in a computer and is intentionally designed to do that.

NOTE: The key difference is that the one is unintentional (bug) while the other is intentional (virus). (2)

- 4.5 A program that can stand independently from the main program and performs a specific program. (2)
[20]

QUESTION 5: NUMBER SYSTEMS

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

Pos. 1 checks 3; 5; 7; 9

1 1 1 1 – P1 should thus be 0: NOT thus: 1

Pos. 2 checks 3; 6; 7; 10

1 1 1 0 – P2 should thus be 1: IT IS thus: 0

Pos. 4 checks 5; 6; 7

1 1 1 – P4 should thus be 1: IT IS thus: 0

Pos. 8 checks 9; 10

1 0 – P8 should thus be 1: IT IS thus: 0

Thus the fault lies on bit $0001_2 = 1_{10}$

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

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

5.2 $+0,11110000 \times 10^{+100}$

$$= 1111_2$$

$$= 8 + 4 + 2 + 1$$

$$= 15_{10} \quad (3)$$

5.3 1011 1100 0011_{XS3}

NOTE: One mark for each nibble (4-bit string). If the subscript is omitted, the answer is wrong. (3)

5.4 1001110₂

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

5.5 $A.(B + C) = A.B + B.C$
 $A + B.C = (A + B).(A + C)$

NOTE: Any variables may be used. (2)

[20]

TOTAL: 100