higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N5

15 April 2021

This marking guideline consists of 9 pages.

QUESTION 1

1.1 $11,2_8 = 001\ 001,010$
$= 1001,01_2$✓

$10,2_{10} = 1010,001_2$✓

$\therefore 11,2_8 \times 10,2_{10} = 1001,01_2 \times 1010,001_2$

```
                    1 0 0 1 0 1
                1 0 1 0 0 0 1✓
-------------------------------
                    1 0 0 1 0 1
              1 0 0 1 0 1 0 0 0 0
          1 0 0 1 0 1 0 0 0 0 0 0✓
          1 0 1 1 1 0 1 1 0 1 0 1
```

$\therefore 11,2_8 \times 10,2_{10} = 1001,01_2 \times 1010,001_2$
$= 1011101,10101_2$✓
$= 5D,A_{16}$✓

(Final answer: 1 × 1 for correct answer and 1 × 1 for correct radix. BOTH MUST BE THERE, i.e. TWO marks or nothing.) (6)

1.2 0 0 0 1 0 1 1 1 , 1 0 0 1 ⟶ 0 0 0 1 0 1 1 1 , 1 0 0 1

1 0 1 0 0 0 1 0 , 0 0 1 1 ⟶ 0 1 0 1 1 1 0 1 , 1 1 0 0+1✓ ⟶ 0 1 0 1 1 1 0 1 , 1 1 0 1✓

No carry: 0 1 1 1 0 1 0 1 , 0 1 1 0

Complement answer: -1 0 0 0 1 0 1 0 , 1 0 0 1✓

-1 0 0 0 1 0 1 0 , 1 0 0 1

And add '1' to LSB: +1✓

1 0 0 0 1 0 1 0 , 1 0 1

$10111,1001 - 10100010,001 = 1\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ ,1\ 0\ 11$✓ $= 138,628_{10}$✓
-138,625$_{10}$

(6)

1.3

$121,3_{16} = 001\ 010\ \ 001\ ,\ 011_2$

$= 1010001,011_2$ ✓

$24,3_{16} = 0010\ 0100,\ 0011_2$

$=100100,\ 0011_2$

$= 100100,001_2$ ✓

```
                                    1 0 . 0 0 1 ✓
100100001 √ 1 0 1 0 0 0 1 0 1 1 , 0 0 0
            1 0 0 1 0 0 0 0 0 1
          - 1 0 0 1 0 0 1 0 0 0   ..... ✓
              1 0 0 1 0 0 0 0 1
            - 1 0 0 1 0 0 1 1 1 .....
```

$\therefore 1010001,011_2 \div 100100,001_2 = 10,001_2$ ✓ rem $\frac{100100111}{100100001}$

$= 2,1_8$ ✓

(Final answer: 1 × 1 for correct answer and 1 × 1 for correct radix. BOTH MUST BE THERE, i.e. TWO marks or nothing. (6)

[18]

QUESTION 2

A¤	B¤	C¤	D¤	¤	E¤	F¤	G¤	H¤
0¤	0¤	0¤	0¤	¤	0¤	0¤	1¤	1¤
0¤	0¤	0¤	1¤	¤	0¤	1¤	0¤	0¤
0¤	0¤	1¤	0¤	¤	0¤	1¤	0¤	1¤
0¤	0¤	1¤	1¤	¤	0¤	1¤	1¤	0¤
0¤	1¤	0¤	0¤	¤	0¤	1¤	1¤	1¤
0¤	1¤	0¤	1¤	¤	1¤	0¤	0¤	0¤
0¤	1¤	1¤	0¤	¤	1¤	0¤	0¤	1¤
0¤	1¤	1¤	1¤	¤	1¤	0¤	1¤	0¤
1¤	0¤	0¤	0¤	¤	1¤	0¤	1¤	1¤
1¤	0¤	0¤	1¤	¤	1¤	1¤	0¤	0¤

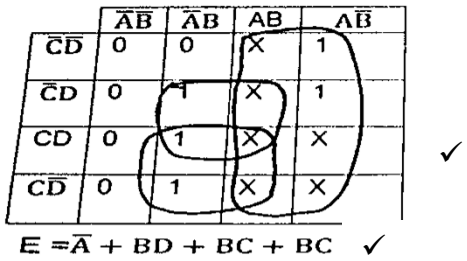
✓

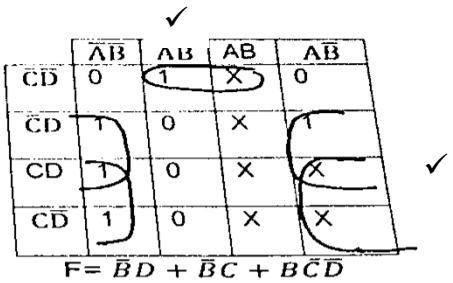
✓

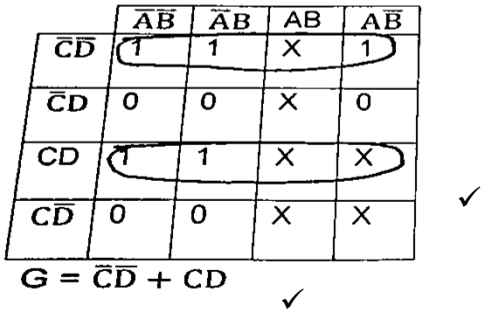
1010
1011
1100
1101
1110
1111

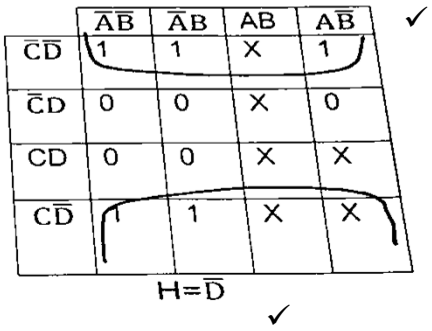
Don't cares (X's) ✓

(3)

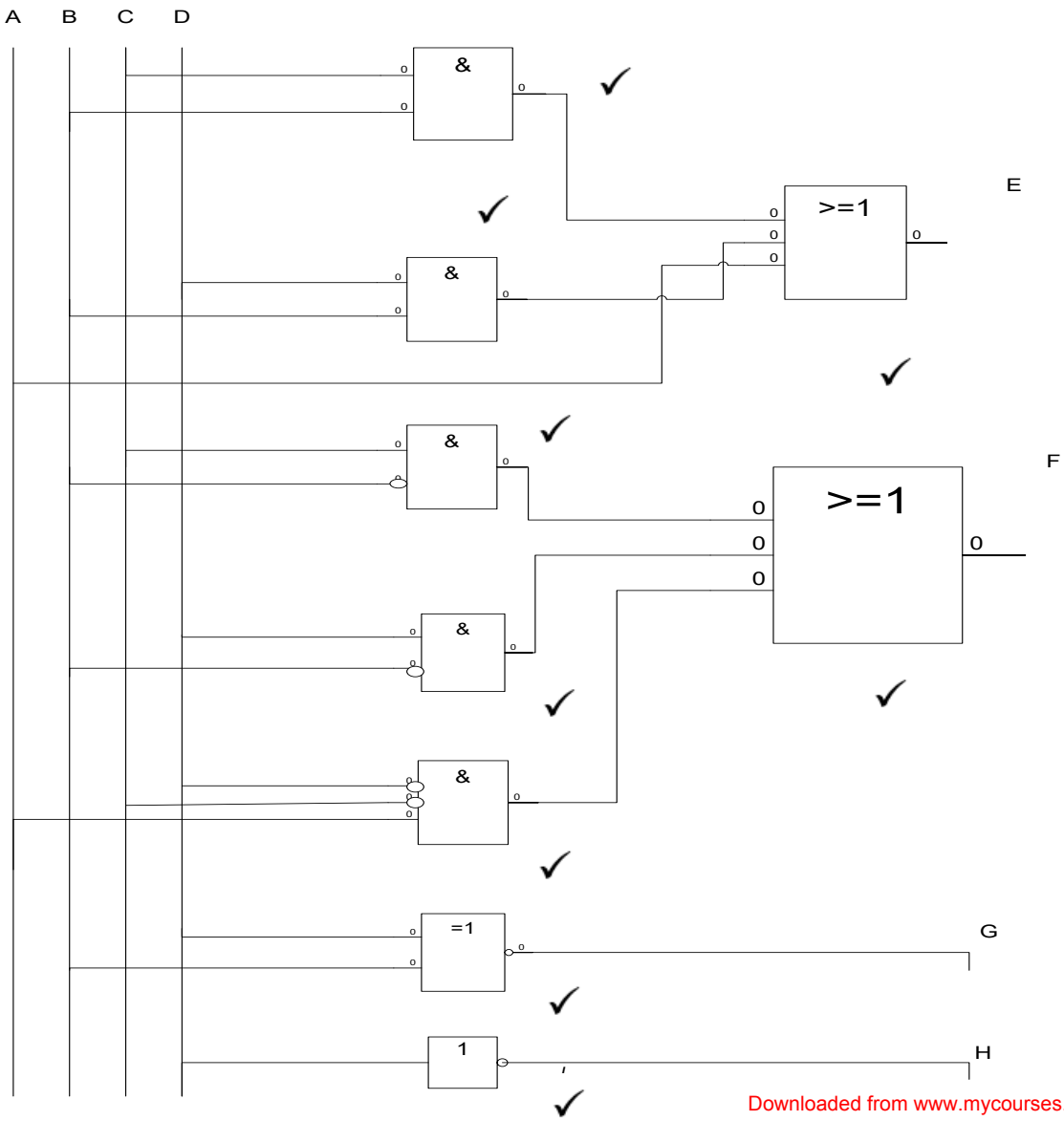








(8)

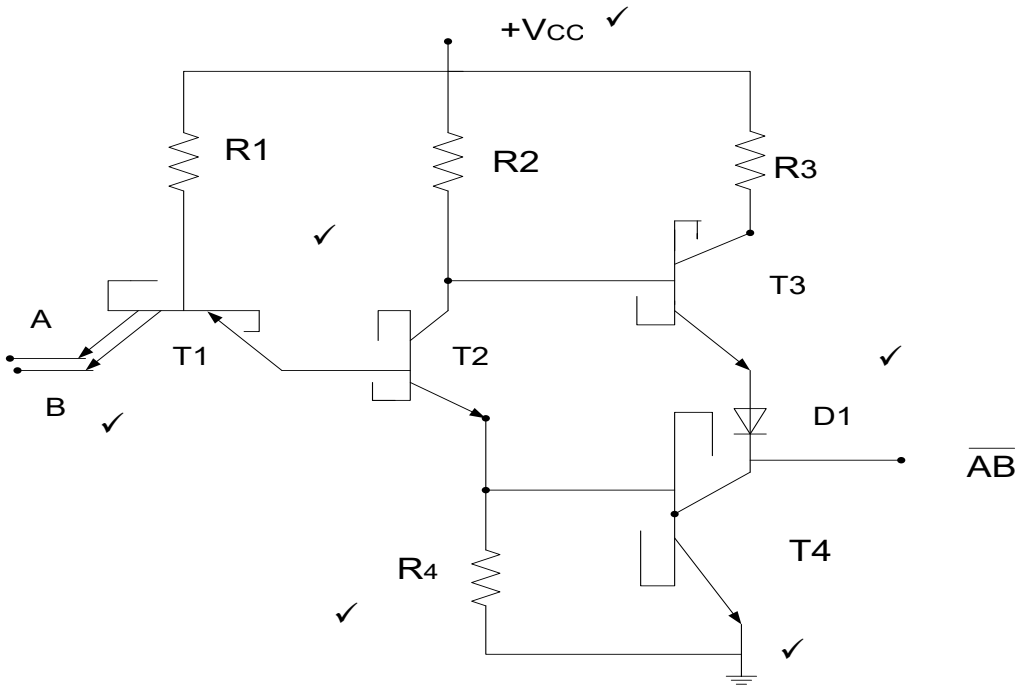


(9)

[20]

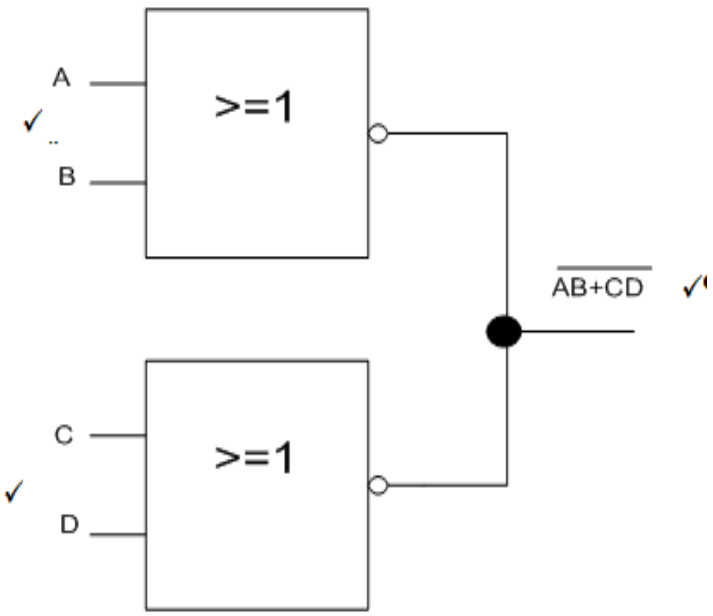
QUESTION 3

3.1



(6)

3.2



(3)

3.3 3.3.1 It is the maximum induced voltage a device can withstand without a false change in output.

3.3.2 It is the time difference between when an input is applied to a gate and when it appears at the output of the gates.

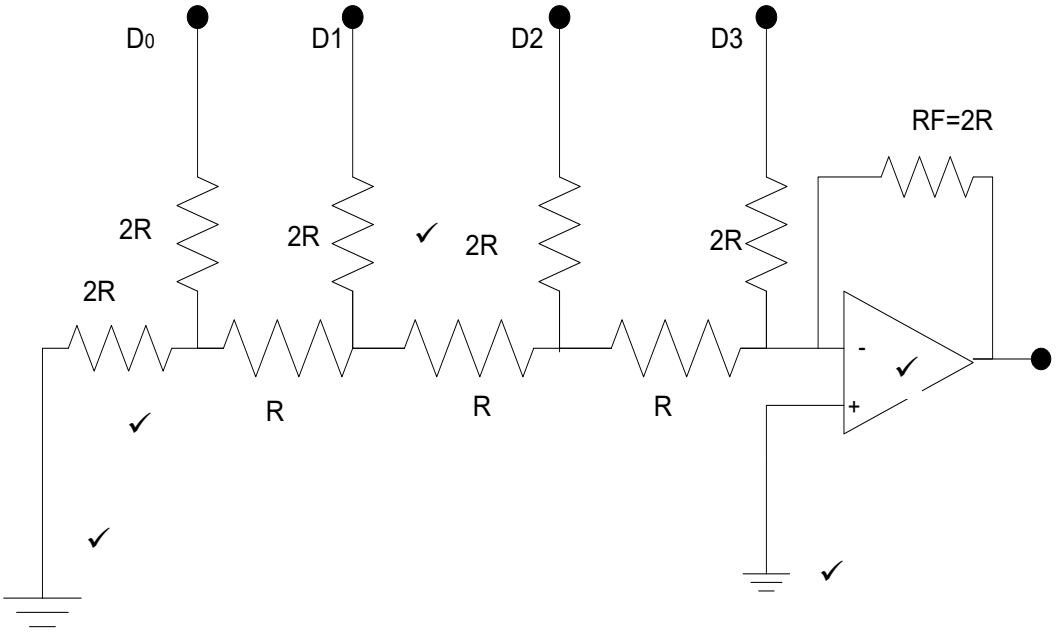
(2 × 2) (4)

[13]

QUESTION 4

4.1 $V_0 = \frac{A \times t \times V_{in}}{RC}$ ✓ $= \frac{1 \times 10^{-3} \times 1 \times 3\,672}{100 \times 10^{3} \times 100 \times 10^{-6}}$ ✓ = 0,3672 V ✓ (3)

4.2



(NOTE: 2 × 1 marks for the correct circuit)
(2 × 1 marks for any correct labelled resistors)
(1 × 1 mark for correct op-amp) (5)

4.3 The R/2R ladder digital-to-analogue converter requires only two resistor values. (1)

4.4 $V_0 = \frac{V_1 + 2V_2 + 4V_4 \cdots}{2^n - 1}$ (1)

[10]

QUESTION 5

5.1

5.1.1	E
5.1.2	F
5.1.3	H
5.1.4	B
5.1.5	A
5.1.6	D
5.1.7	I
5.1.8	C

(8 × 1) (8)

5.2 $\log m_{10} = \log_{10} 2^n$✓

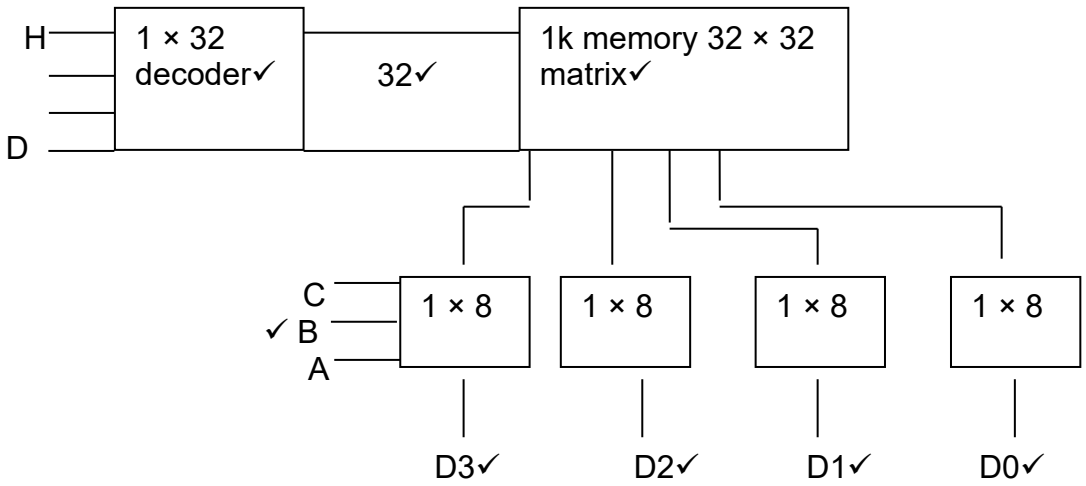
$\therefore \log m = n\log 2$

$\therefore n = \frac{\log m}{\log 2}$✓

$\therefore n = \frac{\log 16384}{\log 2}$✓

$\therefore n = 14$✓ (4)

5.3



(8)
[20]

QUESTION 6

6.1
- Computer display
- Printers
- Projectors
- Speakers
- Game controllers

(Any 2 × 1) (2)

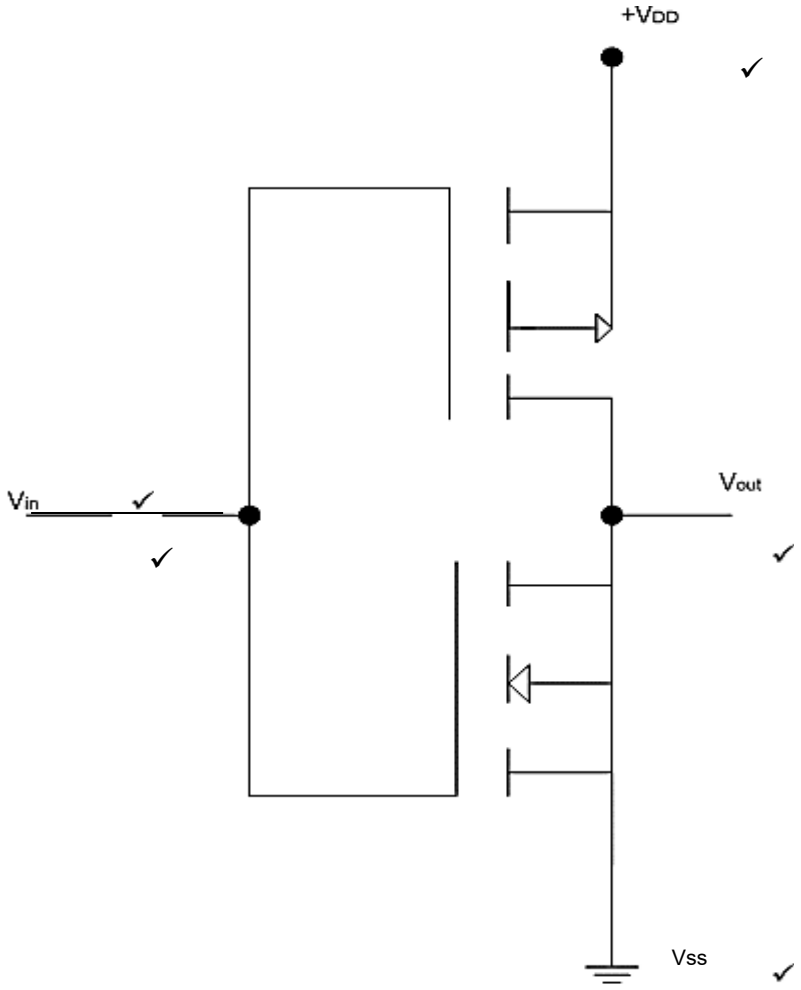
6.2
- Keyboard
- Mouse
- Barcode reader
- Scanner
- Microphone
- Touch screen
- Digital camera

(Any 2 × 1) (2)

6.3
- Chain printers
- Drum printers

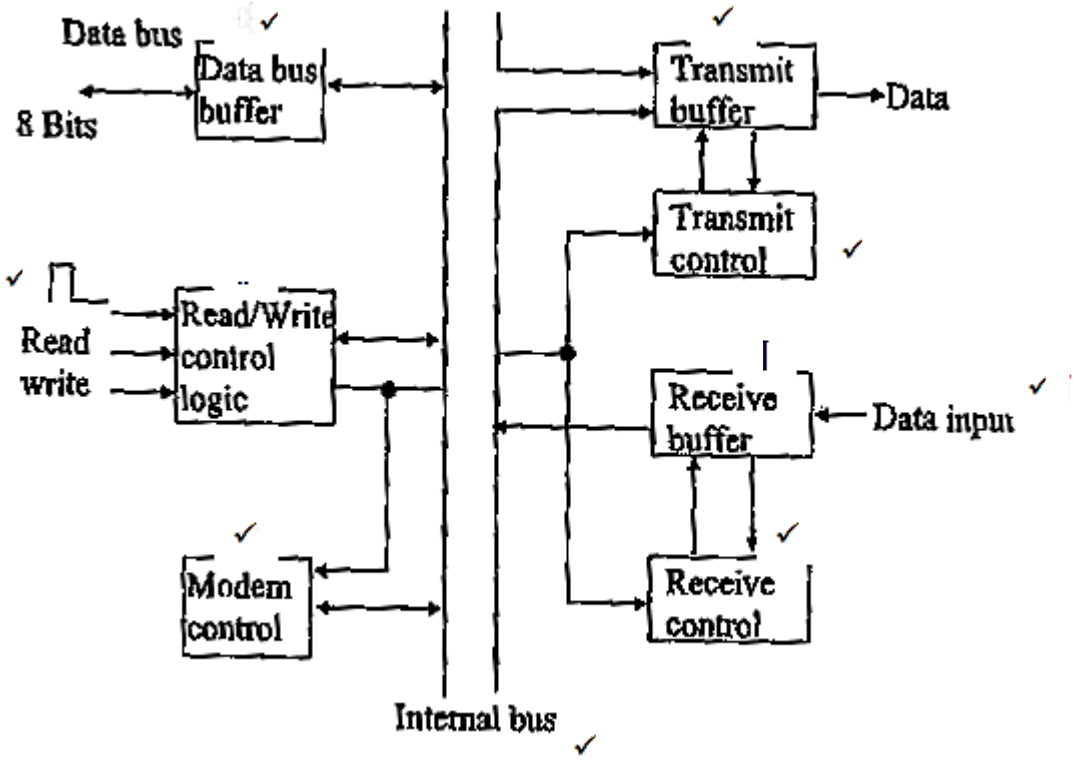
(2)

6.4



(NOTE: 1 × 3 for the correctness of the circuit.)
(1 × 2 for any TWO correct labels.) (5)
[11]

QUESTION 7



[8]

TOTAL: 100