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NATIONAL CERTIFICATE

LOGIC SYSTEMS N5

(8080295)

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Drawing instruments may be used.

This question paper consists of 6 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
LOGIC SYSTEMS N5
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Fully label all circuits.
5. Draw binary registers with the most significant bit (MSB) flip-flop on the left and the least significant bit (LSB) flip-flop on the right.
6. Draw waveforms with the clock input on top followed by the LSB flip-flop output below the clock input, and the MSB flip-flop output as the last output waveform at the bottom.
7. Write neatly and legibly.

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QUESTION 1

A safety circuit in a tractor requires a binary counter that counts as follows:

001_2, 011_2, 101_2, and 111_2.

Design a synchronous binary counter that produces the above count cycle.

The counter must be self-starting and must exit from any unused state to the starting state within ONE clock pulse.

Design and draw the circuit using JK master/slave flip-flops. **[15]**

QUESTION 2

Design a binary counter that will count the following decimal states:

15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5 and 4.

The binary states are given below:

A	B	C	D
1	1	1	1
1	1	1	0
1	1	0	1
1	1	0	0
1	0	1	1
1	0	1	0
1	0	0	1
1	0	0	0
0	1	1	1
0	1	1	0
0	1	0	1
0	1	0	0

The counter must be an asynchronous module-12 counter.

Use JK master/slave flip-flops and show the truth table and waveforms for the counter. **[15]**

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QUESTION 3

3.1 The counting of a signal's pulses for a fixed accurate period of time, usually one second, is known as frequency measurement.

Draw a fully labelled block diagram of a typical frequency counter. (10)

3.2 Draw a typical set of waveforms for the frequency counter in QUESTION 3.1. (5)

[15]

QUESTION 4

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (4.1–4.13) in the ANSWER BOOK.

4.1 Shift registers are used mainly to store data permanently.

4.2 Shift registers are used to count clock pulses.

4.3 A shift of data from LSB to MSB is called left shifting.

4.4 1000_2 is a Johnson Code number.

4.5 Series-in series-out shift registers are also known as S.I.S.O. registers.

4.6 A circulating shift register has its serial input connected to its serial input.

4.7 A circulating shift register has its serial output connected to its serial input.

4.8 A parallel-in serial-out shift register converts serial input to parallel output.

4.9 A Johnson counter is a counter.

4.10 A Johnson counter circulates more than one 1 in each number.

4.11 A Ring counter and a Johnson counter are one and the same.

4.12 1000_2 and 0001_2 are both Johnson and Ring code numbers.

4.13 Two left shifts of 0001_2 result in 0100_2.

(13 × 1) **[13]**

QUESTION 5

5.1 The arithmetic logic unit (ALU) is the circuit responsible for the processing of numbers, i.e. adding, subtraction, multiplication and division of numbers.

Draw a fully labelled block diagram of a typical logic multiplier. (7)

5.2 Explain the operation of the logic multiplier in QUESTION 5.1. (5)
[12]

QUESTION 6

6.1 Explain the purpose of internal memory such as SRAM, DRAM and hard disk storage. (5)

6.2 Choose a description from COLUMN B that matches the type of memory in COLUMN A. Write only the letter (A–J) next to the question number (6.2.1–6.2.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
6.2.1	SRAM	A	utilise(s) semiconductors
6.2.2	RAM	B	an early form of secondary computer memory
6.2.3	ROM	C	has/have hysteresis effect
6.2.4	DRAM	D	random access memory
6.2.5	DRAM and SRAM memories	E	a rotating disk-type memory
6.2.6	Magnetic core memory	F	do/does not require refresh circuitry
6.2.7	MOS memory	G	sequential access-type memory
6.2.8	Magnetic drum memory	H	used to permanently store fixed data
6.2.9	Magnetic disk memory	I	require(s) refresh circuitry
6.2.10	Magnetic tape memory	J	store(s) data in the form of electrostatic charge

(10 × 1) (10)
[15]

QUESTION 7

7.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (7.1.1–7.1.6) in the ANSWER BOOK.

7.1.1 A drum printer uses a laser to print characters.

7.1.2 A thermal printer uses ordinary paper.

7.1.3 Plotters are used to print large images onto large sheets of paper.

7.1.4 A dot matrix printer is a character-at-a-time printer.

7.1.5 Impact printers are generally slow printers.

7.1.6 A thermal printer prints characters as a matrix of dots.

(6 × 1) (6)

7.2 Indicate which of the following printers are IMPACT printers or NON-IMPACT printers by writing only 'Impact' or 'Non-impact' next to the question number (7.2.1–7.2.5) in the ANSWER BOOK.

7.2.1 Thermal printer

7.2.2 A type roll (drum) printer

7.2.3 Inkjet printer

7.2.4 A dot-matrix printer

7.2.5 A character-at-a-time printer

(5 × 1) (5)

7.3 Explain the similarity between a *dot matrix* and a *thermal type printer*. (2)

7.4 Explain the similarity between a *drum* and a *chain (belt) type* printer. (2)

[15]

TOTAL: 100

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