Instructions to Candidates: Answer any *three* questions

Question One *(33 Marks)*

(i)   Convert the decimal number 57 to its binary **and** octal equivalent.

(8 Marks)

(ii)   Show the logic symbol **and** the truth table for: *(8 Marks)*

    (i) NOR gate   (ii)   AND gate

(iii)   Complete the truth table for the expression below: *(9 Marks)*

$$Z = (\overline{A} + B) + \overline{CD}$$

(iv)   Draw the circuit for the expression below: *(8 Marks)*

$$Z = A\overline{B}D + (C \oplus D)$$

Question Two *(33 Marks)*

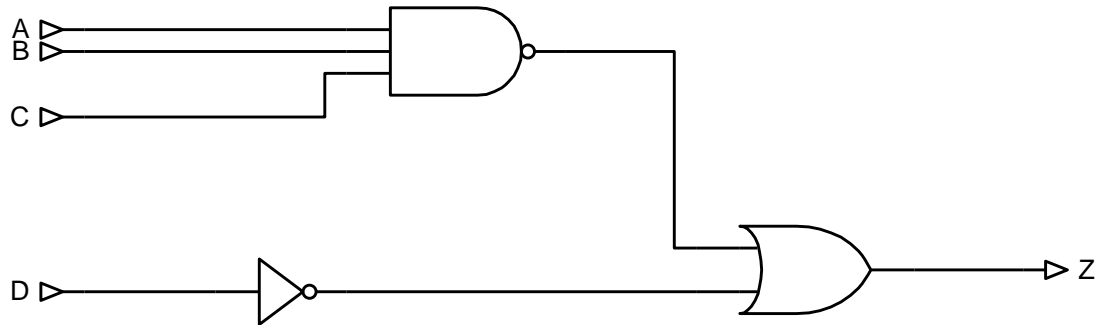(i) Write an expression for the circuit given below:

Figure 1

(9 Marks)

(ii) Design a circuit that gives a TRUE output when input one is opposite to input three.

(12 Marks)

(iii)   Write an expression for Z below. Simplify the expression if possible and draw the circuit.

(12 Marks)

A	B	C	Z
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

## Question Three						*(33 Marks)*

(i)	Show the truth table for the Half-Adder. Hence or otherwise, write the equation for the Half-Adder and show the logic circuits required to implement it.

(12 Marks)

(ii)	Explain how a Full-Adder can be derived from two Half-Adders and some logic circuitry. Use diagrams to support your answer.

(10 Marks)

(iii)	Write a short note on Random Access Memory (RAM), discussing Static-RAM and Dynamic-RAM and highlighting the differences between them. How does ROM differ from RAM?

(11 Marks)

## Question Four						*(33 Marks)*

(i)	Draw a block diagram of a generic CPU, and write a short paragraph describing the function of each component.

(12 Marks)

(ii)	Write a note on the *Instruction Cycle* of the CPU.

(10 Marks)

(iii)	Show how four flip-flops can be connected to form a parallel-in parallel-out register. Show how 1101 would be loaded and read from such a register.

(11 Marks)

Rules of Boolean Algebra

1	A + O = A
2	A + 1 = 1
3	A . O = O
4	A . 1 = A
5	A + A = A
6	A + $\overline{A}$ = 1
7	A . A = A
8	A . $\overline{A}$ = O
9	$\overline{\overline{A}}$ = A
10	A + AB = A
11	A + $\overline{A}$B = A + B
12	(A + B)(A + C) = A + BC

Laws of Boolean Algebra

Commutative	A + B = B + A AB = BA
Associative	A + (B + C) = (A + B) +C A(BC) = (AB)C
Distributive	A(B + C) = AB + AC