



SCHOOL OF PROFESSIONAL STUDIES

BACHELOR OF INFORMATION COMMUNICATION TECHNOLOGY

UNIT CODE/NAME: BCT 223: LOGIC CIRCUITS

January – April 2018/2019 End Semester Exam - Time: 2 Hours

Instructions: Answer Question ONE (Compulsory) and any other TWO questions.

QUESTION ONE

a) Define the following terms (4 marks)

- i) Logic gate
- ii) Registers
- iii) Counter
- iv) Logic family

b) Convert the following numbers:

- i) $14B_{16}$ to binary (3 marks)
- ii) $(378.93)_{10}$ to octal (3 marks)
- iii) $(756.603)_8$ to hexadecimal (3 marks)

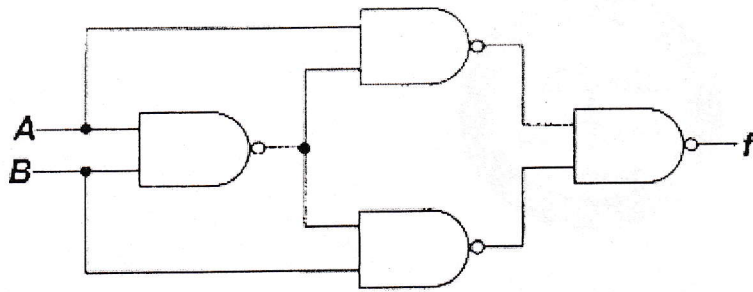
c) Develop the truth table of the following expression. (4 marks)

$$A'B'C \oplus A$$

d) Subtract $(10000)_2$ from $(11010)_2$ using 1's complement (3 marks)

e) In practice the digital electronics requires to handle data which may be numeric, alphabets and special characters. This requires the conversion of the incoming data into binary format before it can be processed. Convert 59.72_{10} to Binary Coded Decimal. (3 marks)

f) Write the output f of the circuit shown below in terms of A and B in the simplest form possible. (3 marks)



g) What is the simplified expression of the following Boolean function:

$$Z = AB'C'D' + ABC'D' + A'B'CD' + AB'CD' + A'BCD' + ABCD' + AB'C'D + ABC'D + A'B'CD + A'BCD + ABCD$$

(4 marks)

QUESTION TWO

a) Simplify the following Boolean expressions using a Karnaugh map.

i) $F(A, B, C, D) = \overline{(C + D)} + \overline{A}C\overline{D} + A\overline{B}C + \overline{A}\overline{B}CD + ACD$ (5 marks)

ii) $f = (A + \overline{B})(\overline{A} + \overline{B})(A + B)$ (5 marks)

b) Discuss the following CMOS logic levels: (5 marks)

- i) Noise immunity
- ii) Noise margin
- iii) Propagation delay time
- iv) Fan out of gates
- v) Power dissipation

QUESTION THREE

a) i) Define the term Sequential circuit (2 marks)

ii) Differentiate between synchronous and asynchronous circuits (2 marks)

b) Sketch the Logic Circuit diagram that implements the equations:

i) $Q = \overline{A + B} + \overline{A}(C + B)$ (4 marks)

ii) $X = \overline{A}B + A\overline{C} + ABC$ (4 marks)

c) Identify any three types of counters that can be used in digital systems. (3 marks)

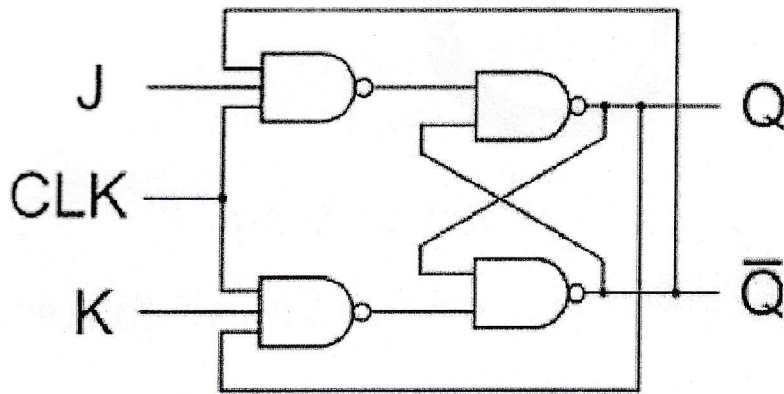
QUESTION FOUR

a) Discuss the application of shift registers in Digital Systems (3 marks)

b) Develop a three input truth table of the Exclusive OR truth table. (4 marks)

c) Highlight the differences between an encoder and a decoder. (4 marks)

- 7) Develop the truth table of the shown JK-flip flop including the comment for each input combination. (4 marks)



QUESTION FIVE

- a) Differentiate between the half adder and the full adder logic circuits. (4 marks)
- b) What is the simplified expression of the following Boolean function:
- i) $F = (p \vee \neg q) \wedge (\neg p \vee \neg q)$ (3 marks)
- ii) $Q = B.C.(\overline{C} + D) + C.D + C + \overline{A}$ (4 marks)
- c) Develop the truth table of the shown SR- flip flop including the comment for each input combination. (4 marks)

