**KABARAK UNIVERSITY**

**UNIVERSITY EXAMINATIONS**

**SECOND SEMESTER, 2017/2018 ACADEMIC YEAR**

**EXAMINATION FOR THE DEGREE OF BACHELOR SCIENCE IN COMPUTER SCIENCE**

**COMP 213: DIGITAL CIRCUIT DESIGN**

**STREAM: Y2S1 TIME:**

**EXAMINATION SESSION : AUGUST DATE: 2018**

**INSTRUCTIONS:**

1. **This question paper has five questions**
2. **QUESTION ONE IS COMPULSORY AND HAS 30 MARKS**
3. **Answer any other two questions worth 20 marks each.**

**QUESTION ONE (30 marks)**

1. What makes it appropriate for digital systems such as computers to work on binary variables in their operations? **(2mks)**
2. Show any three disadvantages of analog signals over digital signal **(3mks)**
3. Construct a three input NAND gate giving its logic equation and all the possible outputs in a truth table. **(5mks)**
4. Explain the duality of De-Morgan’s Theorem **(2mks)**
5. Draw the block diagram of half adder giving the equations for the outputs with their truth table. **(5mks)**
6. Demonstrate the use of buffers in digital electronics **(2mks)**
7. If a 3-input XNOR gate has eight input possibilities, show all the possible outputs with their respective outputs. **(4mks)**
8. *C*onstruct a 8-to-1 multiplexer showing all the possible inputs and output.**(5mks)**
9. Draw the symbol and the equation for XOR gate **(2mks)**

**QUESTION TWO (20 marks)**

1. Prove that a NOR gate is equivalent to a bubbled AND gate **(3mks)**
2. Explain any three characteristics of a combinational circuit **(3mks)**
3. Give any three applications of decoders **(3mks)**
4. Draw the block diagram for S-R latch using NAND gate. What happens when all the inputs are ‘1’? **(4mks)**
5. Prove that ***A (B+C) = (A B) + (A C)* (4mks)**
6. Draw the circuit diagram for the equation ***F*(*x*, *y*, *z*) = *y* + *x'z*.** **(3mks)**

**QUESTION THREE (20 marks)**

1. What is the difference between sum of product(SOP) and product of sums (POS) forms **(2mks)**
2. What is the difference between an encoder and a multiplexer **(2mks)**
3. Use the Boolean algebra to minimize the following equation

***F=(x’+y’+x’y’+xy)(x’+yz)* (4mks)**

1. Show that ***(a + b)( a + c)*** is logically equivalent to ***a + bc***. Draw the logic circuits for each **(6mks)**
2. Explain the following

i) Karnaugh map **(2mks)**

ii) Combinational logic circuit **(2mks)**

1. What is the importance of a clock in a flip flop **(2mks)**

**QUESTION FOUR (20 marks)**

1. Explain the use of exclusive-OR in the design of full adder **(3mks)**
2. To reduce the number of intergrated circuits, multiplexer is used. Explain how a 4-line to 1-line multiplexer works **(4mks)**
3. Simplify the following expression using a Karnaugh map:

eq_05 **(4mks)**

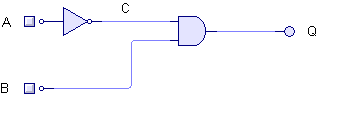
1. Show the map by their equivalent decimal values in the respective cells in a 4 input variable K-map **(3mks)**
2. State any four postulates of Boolean algebra. **(4mks)**
3. What is the equivalence of 2-input XOR equation **(2mks)**

**QUESTION FIVE (20 marks)**

1. Explain the implementation of 3-8 decoder using AND gate **(5mks)**
2. Use the Karnaugh map to solve the following function

***F*1(*x*, *y*, *z*) = Σ(3, 5, 6, 7)** **(4mks)**

1. Explain the distributive law of boolean algebra **(2mks)**
2. Differentiate between leading and trailing edge in clock used for memory elements **(2mks)**
3. Draw the half adder circuit and give the equations of the outputs of the sum and carry **(3mks)**
4. Study the following logic system carefully and then draw the truth table for it



**(4mks)**