Bangladesh Army University of Science and Technology

Department of Computer Science and Engineering

Final Examination, Fall 2018 — **Level-2** **Term-I**

Course Code: CSE 2101 — **Course Title: Digital Logic Design**

Time: 03 (Three) hours — **Full Marks: 210**

N.B. (i) Answer any three questions from each PART (ii) Use separate answer script for each PART
(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)---------N/A----------

PART A

(Answer any three questions)

1. a) What is a combinational logic circuit? Answer the following questions for the Figure-1(a). 3+15 =18

   (i) Find the expression and make truth table of the circuit.

   (ii) Redraw the circuit with only NAND gate.

   (iii) Simplify the logic circuit.

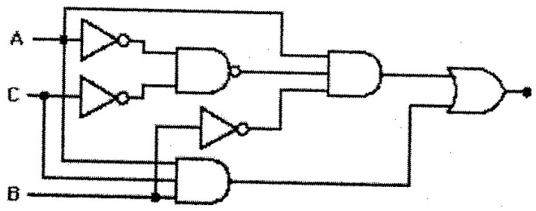

Figure-1(a)

   b) Design a logic circuit that has four inputs (A, B, C and D) and an output (Y), such that, the output is 1 whenever the decimal equivalent of $ABCD_2$ is divisible by either 3 or 5. 12

   c) Prove that: $A \oplus B \oplus AB = A + B$ 5

2. a) Design a 1:16 DEMUX using 1:4 DEMUX. Write the truth table of it. 10+8 =18

   b) Given the following truth table: 4+6=10

Inputs			Outputs	
A	B	C	X	Y
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

   (i) Derive the logic expressions for X and Y.

   (ii) Express X and Y in both SOP and POS forms.

   c) What is the difference between a ripple binary adder and a look-ahead carry adder? 7

3. a) What is comparator? Derive the logic expression and draw the circuit of 4-bit comparator. 3+12 =15

   b) A logic circuit is defined by the following functions: 14

$$f_1 = \overline{A}\,\overline{B} + AB\overline{C}$$

$$f_2 = \overline{A} + B$$

$$f_3 = \overline{A}\,\overline{B} + AB$$

   Draw the circuit with a decoder and external gates.

   c) What are the advantages and disadvantages of encoding a decimal number in BCD as compared with straight binary? 6

4. a) Realize the following function with
   (i) A 16:1 MUX
   (ii) An 8:1 MUX

$$f(A,B,C,D) = \sum m(2,4,6,7,9-12,15)$$

b) Construct the Hamming codes for 1011101. If the received code has error in one position, how to locate the error bit? 8+7=15

PART B

(Answer any three questions)

5. a) A sequential circuit has two flip-flops A and B, two inputs x and y, and one output z. The flip-flop input equations and circuit output equations are: 5+5+5 =15

$J_A = A.x + B.y$
$K_A = A.B + x.y$
$J_B = A.x$
$K_B = A.B.x + B.y$
$z = A.x.y + B.x.y$

For the above mentioned circuit:
   (i) Draw the logic diagram of the circuit
   (ii) Derive the state table
   (iii) Draw the state diagram

b) What is the characteristic equation of a flip-flop? Derive the characteristic equation and the state diagram for a J-K flip-flop. 5+5 =10

c) What is the difference between a counter and shift register? 5+5 =10

6. a) Implement the following Boolean functions by using (i) PROM and (ii) PLA. 10+10 =20

$$F_0(u,v,w) = \sum m(1,4,6)$$
$$F_1(u,v,w) = \sum m(0,1,2,6,7)$$
$$F_2(u,v,w) = \sum m(0,2,6)$$
$$F_3(u,v,w) = \sum m(1-3,5)$$

b) Construct a 64×4 memory chip from 16×4. 15

7. a) Design a Synchronous counter using following sequence: 0,9,1,8,2,7,3,6,4,5,0,…. 25

b) What are the operations performed by a memory unit? 6

c) What is the difference between a Synchronous and an Asynchronous counter? 4

8. a) What is a Universal Shift Register? How can we use it as SISO, SIPO, PISO and PIPO? 5+10 =15

b) Find circuit, counting sequence and name of the circuit from the following timing diagram: 15

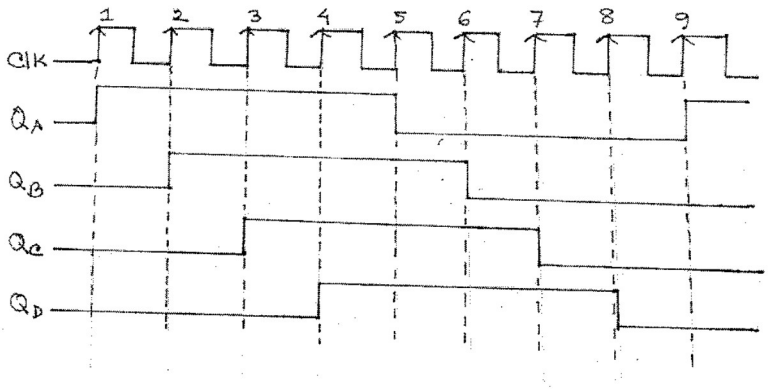

Figure-8(b)

c) What is the difference between EPROM and EEPROM? 5