Hajee Mohammad Danesh Science and Technology University, Dinajpur

Semester Final Examination - 2014 (January-June)

B.Sc in CSE

Level: 4 Semester: I Credit: 3.0

Course Code: CEN 403 Course Title: Digital System Design

Time: 3 Hours **Total Marks: 90**

[NB: The figure in the right margin indicates the marks for the respective question. Split answer of any question is unacceptable]

Section-A

Answer any 3 (three) of the followings

1.	a)	Mention some differences between Analog and Digital System.	3
	b)	Design a combinational circuit that accepts four inputs to generate an output, which is equal to 1 when an odd number of inputs are equal to 1.	5
	c)	Implement a NAND gate with only NOR gates.	2
	d)	What is Excess-3 code? Design a BCD to Excess-3 code converter.	5
2.	a)	What is Binary parallel adder? Why is it called Parallel?	2
	b)	Sketch the block diagram of a BCD adder. Explain why two Binary parallel adders are needed to construct a BCD adder.	4
	c)	Implement the Boolean function using multiplexer- $F(A, B, C, D) = \sum(0, 1, 3, 4, 8, 9, 14)$.	6
	d)	Show how a 4×16 decoder can be constructed with two 3×8 decoders.	3
3.	a)	Define Sequential logic circuit. Mention some differences between Synchronous and Asynchronous Sequential circuits.	3
	b)	Draw the logic diagram of clocked JK flip-flop and describe how does it solves the indeterminate conditions of the clocked RS flip-flop.	4
	c)	Show the State Table, State Diagram and Characteristics Equation of Clocked T flip-flop with its logic diagram.	5
	d)	Sketch and explain how a basic AND gate can be implemented using TTL.	3
4.	a)	Define Register and Counter in terms of Flip-flop. Write some differences between Register and Counter.	4
	b)	Show the implementation of a 4×4 Integrated memory using RAM cell.	4
	c)	Design a four-bit Binary Ripple counter with JK flip-flop.	5
	d)	Explain the reason, why is it possible to have more capacity in a ROM then in a RAM with same chip size.	2

Section-B

Answer any 3 (three) of the followings

1. a) Define Digital System? Discuss the characteristics of a Digital System. 3

   b) What is meant by Micro-operation? Briefly describe the types of micro-operation performed on the information stored in computer registers. 4

   c) What is Instruction Fetch Cycle? Show the list of Register-transfer statements for the following instructions in term of Instruction Fetch Cycle- 6
      i) A←R
      ii) A← OPRD
      iii) A←M[ADRS]

   d) Show the hardware implementation of the following statement. Include logic gates for the control function: $x'y'T_0 + T_1 + xy'T_2 : A \leftarrow A+B$ 2

2. a) Define Processor and CPU. Explain the importance of registers for a processor in a digital system. 3

   b) Show the procedure with necessary diagrams, how F=A+B, F=A-B and F=A arithmetic operations can be obtained using Binary parallel adder? 5

   c) Design an Adder/Subtractor circuit with only selection line S and two 4-bit inputs, A and B. When S=1 the circuit performs A+B. When S=0 the circuit performs A-B by taking the 2's complement of B. 5

   d) What is Accumulator register? Describe its importance in a digital system. 2

3. a) Write the importance of Control Unit in Digital Computer. 3

   b) Explain the One flip-flop per state design method of control unit. How is this method similar to a Ring counter? 5

   c) Describe the procedure of sign-magnitude addition and subtraction with necessary flowchart. 5

   d) Discuss the concept of Control word, Control memory and Microprogramming. 2

4. a) Define Diode and Transistor. Explain, how the characteristics of a Diode can be obtained from a Transistor. 2

   b) Write short note on VESA and PCI bus. 4

   c) Sketch the circuit diagram of a Static RAM cell and describe how data is stored inside it. 3

   d) Compare the characteristics of the following digital logic families: 6
      i) MOS vs CMOS
      ii) TTL vs RTL
      iii) TTL vs CMOS