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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Third Semester B.Tech Degree (S,FE) Examination December 2020 (2015 Scheme)

**Course Code: CS203**

**Course Name: SWITCHING THEORY AND LOGIC DESIGN**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks.*

Marks

- |   |                                                                                                        |     |
|---|--------------------------------------------------------------------------------------------------------|-----|
| 1 | a) $(162)_8 + (537)_8 =$                                                                               | (3) |
|   | b) $(37A)_{16} + (4B9)_{16} =$                                                                         |     |
| 2 | Using truth table prove that $(A+B)' = A'B'$                                                           | (3) |
| 3 | Perform subtraction using 2's complement method.                                                       | (3) |
|   | a) $(100)_2 - (110000)_2$                                                                              |     |
|   | b) $(11010)_2 - (1101)_2$                                                                              |     |
| 4 | Express the given function in sum of minterms and product maxterms form.<br>$F(A,B,C) = C(A'+B) + B'C$ | (3) |

**PART B**

*Answer any two full questions, each carries 9 marks.*

- |   |                                                                                                                                                                           |     |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 5 | a) Perform the following conversions.                                                                                                                                     | (5) |
|   | i) $(231B)_{16} = ( )_2$                                                                                                                                                  |     |
|   | ii) $(574.32)_{10} = ( )_2$                                                                                                                                               |     |
|   | iii) $(10110011.01)_2 = ( )_8$                                                                                                                                            |     |
|   | iv) $(107)_8 = ( )_{10}$                                                                                                                                                  |     |
|   | v) $(2671)_{10} = ( )_{16}$                                                                                                                                               |     |
|   | b) Convert the decimal number $5.62 \times 10^3$ to IEEE 754 standard single precision floating point binary number.                                                      | (4) |
| 6 | a) Simplify the Boolean function F using the don't care conditions d, in SOP and POS forms.<br>$F(A,B,C,D) = A'B'D' + A'CD + A'BC$<br>$d(A,B,C,D) = A'BC'D + ACD + AB'D'$ | (5) |
|   | b) The sum of all minterms of a Boolean function of $n$ variables is 1. Prove the above statement for $n=3$ .                                                             | (4) |

02000CS203092001

- 7 a) Simplify the given function using Tabulation method and determine the prime implicants, essential prime implicants and the minimized Boolean expression. (9)
- $F(A,B,C,D) = \Sigma(0,2,6,8,9,10,11,13,15)$

**PART C**

*Answer all questions, each carries 3 marks.*

- 8 Implement Exclusive-OR using only NAND gates. (3)
- 9 Draw the truth table and the logic circuit of a full adder. (3)
- 10 Explain race around condition in JK flip-flop. (3)
- 11 Draw the logic diagram of a D flip-flop using only NAND gates. Draw the characteristic table and obtain the characteristic equation. (3)

**PART D**

*Answer any two full questions, each carries 9 marks.*

- 12 a) A combinational circuit is defined by the following two functions. (5)
- $F_1 = x'y' + xyz'$   
 $F_2 = x' + y$
- Design the circuit with a decoder and external gates.
- b) Implement the function  $F(A,B,C) = \Sigma(0,2,3,5)$  using a 2X1 MUX. (4)
- 13 a) Design a magnitude comparator that compares two 3 bit numbers A and B. (5)
- b) Design a circuit that implements an SR flip-flop using a D flip-flop. (4)
- 14 a) A sequential circuit has two flip-flops A and B and one input x. The flip-flop input functions are as follows. (9)
- $J_A = xB$  ,  $K_A = xB'$   
 $J_B = x'A'$  ,  $K_B = x + A$
- Obtain the state table, state diagram and state equations.

**PART E**

*Answer any four full questions, each carries 10 marks.*

- 15 a) Draw the circuit diagram of a 4-bit bidirectional shift register with parallel load and explain its working. (10)
- 16 a) Design a serial adder using a sequential-logic procedure (7)
- b) Explain the different types of ROMs. (3)
- 17 a) Design a counter with the following binary sequence: 0, 1, 3, 7, 6, 4 and repeat. (6)
- Use T flip-flops.
- b) Write an HDL code for a half adder in structural style of modelling. (4)



02000CS203092001

- 18 a) Explain PLA with a block diagram. (4)  
b) A combinational circuit is defined by the functions: (6)  
 $F_1(A,B,C) = \Sigma(3,5,6,7)$   
 $F_2(A,B,C) = \Sigma(0,2,4,7)$   
Implement the circuit with a PLA having three inputs, four product terms and two outputs.
- 19 a) Draw a flow chart and explain the addition and subtraction of two binary numbers in signed magnitude representation. (10)
- 20 a) Differentiate between synchronous and asynchronous counters. (4)  
b) Draw the circuit diagram of a 4- bit binary ripple counter and explain its working. (6)

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