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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (R, S) / S1 (PT) (S, FE) Examination December 2023 (2019 Scheme)

Course Code: CST203

Course Name: Logic System Design

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer all questions. Each question carries 3 marks*

Marks

- |    |  |     |
|----|--|-----|
| 1  | Convert the decimal number 250.5 to base 7 and base 8.   | (3) |
| 2  | Represent the decimal number 8623 in BCD, Excess-3 code and 2421 code.   | (3) |
| 2  | Using the postulates and theorems of Boolean algebra, simplify the expression $(A+B)^1(A^1+B^1)^1$   | (3) |
| 4  | A bank vault has three locks with a different key for each lock. Each key is owned by a different person. In order to open the door, at least two people must insert their keys into the assigned locks. The signal lines A, B and C are 1 if there is a key inserted into lock 1, 2 or 3 respectively. Write a minimized Boolean expression for the variable Z which is 1 iff the door should open. | (3) |
| 5  | A combinational circuit is defined by the following three functions.<br>$F_1 = x^1y^1 + xyz^1$ $F_2 = x^1 + y$ $F_3 = xy + x^1y^1$<br>Design the circuit with a decoder and external gates.  | (3) |
| 6  | Design a combinational circuit to check for odd parity of four bits.   | (3) |
| 7  | What are ripple counters?  | (3) |
| 8  | Convert SR to T flipflop   | (3) |
| X  | Convert $(17.5)_{10}$ to 32-bit single precision IEEE 754 binary floating point standard   | (3) |
| 10 | Find the modulus of 8-bit Ring, Johnson and Synchronous counter.   | (3) |

**PART B***Answer any one full question from each module. Each question carries 14 marks*  
Module 1

- X a) Perform the following operations (6)
- i)  $(367)_8 + (715)_8$       ii)  $(56A.49)_{16} + (98B.5A)_{16}$       iii)  $(1230)_4 + (23)_4$



- b) Perform the following
- BCD subtraction  $(7235)_{10} - (346)_{10}$  in 10's complement method (8)
  - Subtract  $(9F2C)_{16}$  from  $(A96B)_{16}$  in 16's complement method
- 12 a) Perform the following operations using 2's complement representation (5)
- $(+12) - (+50)$       (ii)  $(+85) - (+43)$
- b) Convert the following numbers from the given base to the bases indicated (8)
- Octal 623.77 to decimal, binary and hexadecimal
  - Hexadecimal 2AC5.D to decimal, octal and binary.
  - Decimal number 85 to BCD and Excess-3 code.

## Module 2

- ~~X~~ a) Implement  $F(A, B, C) = \sum_m(0, 1, 5)$  using only NAND gates. (7)
- b) Simplify the Boolean expression  $Y(A, B, C, D) = \prod_M(0, 1, 3, 5, 6, 7, 10, 14, 15)$  using K-map in Product of Sums form. (7)
- 14 a) Simplify  $F(a, b, c, d) = \sum(1, 3, 4, 5, 9, 10, 11) + \sum_d(6, 8)$  using tabulation method. (10)
- b) Implement AND gate using only NOR gates. (4)

## Module 3

- ~~X~~ a) Explain the operation of a 4-bit magnitude comparator circuit with a neat logic diagram. (10)
- b) Construct a full adder using two half adder circuits. (4)
- ~~X~~ a) Draw the circuit of a BCD adder and explain its working. (8)
- ~~X~~ b) Implement  $F(A, B, C, D) = \sum_m(0, 1, 3, 4, 8, 9, 15)$  using 8 x 1 MUX. (6)

## Module 4

- ~~X~~ a) Design a synchronous counter with the following binary sequence 0, 1, 3, 7, 6, 4 and repeat. Use T flipflops. (10)
- b) The truth table of AB flipflop is given as (4)

A	B	$Q_{n+1}$
0	0	0
0	1	$Q_n$
1	0	$Q_n'$
1	1	1

Write the excitation table and characteristic equation of AB Flipflop

- 18 a) Explain how a master slave flipflop eliminates race around condition. (7)
- b) Draw the logic diagram and timing diagram of a mod-5 ripple counter. (7)

**Module 5**

- ~~X~~ a) Draw a flowchart and explain the addition/subtraction of binary numbers in sign-magnitude form (10)
- b) Draw the logic diagram of a 5-bit Johnson counter (4)
- 20 a) Implement a 4-bit bidirectional shift register with parallel load. (8)
- b) Design a BCD to Excess -3 code converter using ROM. (6)