

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

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

**Course Code: IT201**

**Course Name: DIGITAL SYSTEM DESIGN**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any two full questions, each carries 15 marks.*

Marks

- 1 a) Convert  $(84.25)_{10}$  to binary, octal and hexadecimal. (3)
- b) Perform subtraction using r's complement of the subtrahend of : (4)  
 $(5A.36)_{16} - (201.24)_{16}$
- c) Determine the base of the numbers in the operation;  $42 - 14 = 26$ . (3)
- d) Represent the decimal number 3581 in BCD, Excess-3 code, 2421 code, 6311 code, and 84-2-1 code. (5)
- 2 a) What is a prime implicant? What is an essential prime implicant? Give an example to distinguish between prime implicant and essential prime implicant. (5)
- b) Without reducing, find the complement of the Boolean function: (5)  
 $F = B + \bar{B}(A\bar{C} + AB)$ . And prove that  $F + \bar{F} = 1$  and  $F.\bar{F} = 0$ .
- c) Simplify the Boolean expression into (i) sum-of-product and (ii) product-of-sum. (5)  
 $F = \bar{B}\bar{C} + A\bar{B} + \bar{B}\bar{D} + ABC\bar{C} + ABC\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}CD + \bar{A}\bar{B}CD$
- 3 a) Represent the unsigned decimal numbers  $572.36$  and  $687.73$  in BCD. Show the necessary steps to perform the sum of these BCD numbers. (7)
- b) Minimise the following Boolean function: (8)  
 $F(A, B, C, D) = \Sigma_m(2, 4, 5, 10, 12, 13) + \Sigma_d(0, 3, 8, 11, 15)$

**PART B**

*Answer any two full questions, each carries 15 marks.*

- 4 a) Without reducing, implement the Boolean function  $F = A(\bar{B}D + C) + \bar{C}D$  using NAND and INVERT gates only. (5)
- b) Design a full adder. Using full adders implement a 4-bit adder-subtractor circuit. (10)
- 5 a) What are the differences between a truth table, a state table, a characteristic table and an excitation table? (5)
- b) Implement a positive edge-triggered D-flip flop using three SR latches with (10)

preset and clear. Justify your implementation.

- 6 a) Give the characteristics table for JK and T – flip flop. What are the characteristics equations JK and T flip-flops? (5)
- b) Design a code converter that converts a decimal digit from BCD to 84-2-1 code. (10)

### PART C

*Answer any two full questions, each carries 20 marks.*

- 7 a) What is a Universal shift register? What are the capabilities of a general universal shift register? Give the circuit diagram of universal shift register. (10)
- b) Design a counter with binary count sequence 1-2-5-7-1. Use J-K flip-flop to implement the counter. Show the complete timing diagram for eight clock pulse. (10)
- 8 a) Write the HDL gate-level dataflow description of a four bit adder. (6)
- b) Implement the following two Boolean functions with a PLA: (10)
- $$F_1(A, B, C) = \sum(0, 2, 3, 7)$$
- $$F_2(A, B, C) = \sum(0, 1, 2, 6, 7)$$
- c) List the steps that must be taken during write and read operations of a RAM? (4)
- 9 a) What are the characteristics of different types of ROM? (5)
- b) Draw and explain the logic of a binary cell to store one bit of information. (5)
- c) Design and construct a Johnson counter with 8 distinguishable states. Give its timing diagram. (10)

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