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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree Examination December 2020 (2019 Scheme)

Course Code: ITT203

Course Name: DIGITAL SYSTEM DESIGN

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks Marks

1 Determine the base of the numbers in the following operations: (3)

a) **31 / 2 = 13**

b) **104 + 117 = 223**

2 Using 8-bits, give the 1's and 2's complement representation of the following decimal numbers. (3)

a) +54

b) -68

3 Draw the truth table for the function F(x,y,z) = xyz' + x'y'. (3)

4 The product of all maxterms of a Boolean function of n variables is 0. Prove the above statement for n=2. (3)

5 Construct a 4 X 16 decoder with two 3 X 8 decoders. (3)

6 Design and implement a half subtractor. (3)

7 Differentiate between a latch and a flip flop. Draw the logic diagram of D-latch and D- flip-flop. (3)

8 Derive the characteristic table and characteristics equations of D, JK and T flip-flops. (3)

9 Differentiate between RAM and ROM. (3)

10 Explain PLA with a block diagram. (3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11 a) Represent the decimal digits (0 to 9) using BCD, 2421 code, gray code and excess-3 code. (8)

b) Perform the following operations (6)

i) $(367)_8 + (175)_8$

ii) $(1A36)_{16} + (37E1)_{16}$

iii) $(162)_8 - (457)_8$

12 a) Represent the unsigned decimal numbers 786.25 and 232.58 in BCD. Show the necessary steps to find their sum and difference. (8)

b) Perform the following base conversions. (6)

i) $(4A10)_{16}$ to Octal

ii) $(91.60)_{10}$ to binary

iii) $(132)_4$ to decimal

Module 2

13 a) Minimize the Boolean function $F(A,B,C,D)= \Sigma (0,1,5,7,8,9,10,11,14,15)$ using McClusky minimization technique. (10)

b) Express the following Boolean functions:

i) $F_1(A,B,C,D) = AC + B'D + CD'$ in sum of Minterms form.

ii) $F_2(A,B,C,D) = C (A+B'+D) (B' + C')$ in product of Maxterms form. (4)

14 a) Simplify the given Boolean function and don't care condition using K-map (7)

$$F(w,x,y,z)= w'(x'y + x'y') + x'z'(y + w)$$

$$d(w,x,y,z)= w'x (y'z + yz) + wyz$$

b) Simplify the given Boolean function using K- Map and obtain the simplified expression in SOP and POS forms.

$$F(A,B,C,D) = \Sigma_m(0,2,4,5,7,13,14) + \Sigma_d(3,6,12,15)$$ (7)

Module 3

15 Design a 4-bit Gray to Binary code converter. (14)

16 a) What is a multiplexer? Draw the logic diagram of a 4X1 multiplexer, clearly indicating the inputs and outputs. (5)

b) Implement the function $F(A,B,C,D)= \Sigma(0,3,5,7,9,12,13)$ using (9)

i) 8 X 1 MUX ii) 4 X 1 MUX

Module 4

17 a) Draw the circuit of clocked RS flip flop using NAND gates. Obtain the characteristic table and characteristic equations also. (5)

b) Design JK Flip Flop by using SR Flip Flop (9)

18 a) Compare Synchronous and Asynchronous sequential circuits. (4)

b) A sequential circuit has two flip flops (A and B), one input (x) and one output (z). The flip flop input functions and the circuit output functions are as follows. (10)

$JA = xB+B'$ $KA = xB'$

$JB = xA'$ $KB = x+A$

$z = xA + x'B$

Obtain the state table, state diagram and state equations.

Module 5

19 a) Draw the circuit of a 4-bit synchronous binary counter and explain its working. (5)

b) Design a serial adder using a sequential logic procedure. (9)

20 a) Draw and explain 4 bit Johnson counter. Also draw its timing sequence. (7)

b) Implement a 4- bit bidirectional shift registers with parallel load and explain its working. (7)

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