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B.TECH. III SEM MAIN/BACK (NEW SCHEME)
ACADEMIC SESSION 2023-24

(Artificial Intelligence And Data Science)
III And Other Branches

3AD4–02 - Digital Electronics

Common to CS, IT, AI, DS, MC, CM, CD, CA, AD, AM, CY, IO

Time : 3 Hours]

[Max. Marks : 70

[Min. Passing Marks :

Instructions to Candidates :

Part–A : Short Answer Type Questions (up to **25** words) $10 \times 2 = 20$ marks. All 10 questions are compulsory.

Part–B : Analytical/Problem Solving questions $5 \times 4 = 20$ marks. Candidates have to answer 5 questions out of 7.

Part–C : Descriptive/Analytical/Problem Solving questions 3×10 marks = 30 marks. Candidates have to answer 3 questions out of 5.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.

Use of the following supporting materials is permitted during examination. (Mentioned in form no. 205).
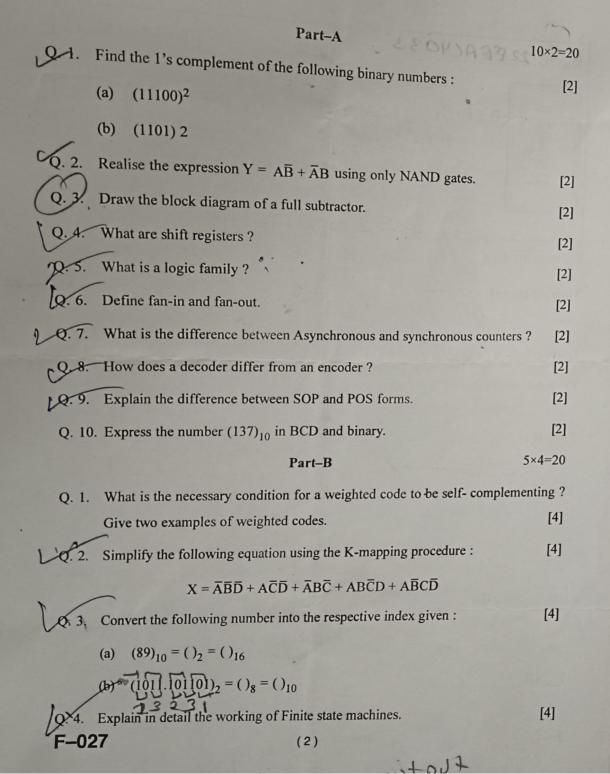
1 __NIL_____

2 __NIL_____

Part–A

10×2=20

Q.1. Find the 1's complement of the following binary numbers : [2]

(a) $(11100)_2$

(b) $(1101)_2$

Q. 2. Realise the expression $Y = A\bar{B} + \bar{A}B$ using only NAND gates. [2]

Q. 3. Draw the block diagram of a full subtractor. [2]

Q. 4. What are shift registers ? [2]

Q. 5. What is a logic family ? [2]

Q. 6. Define fan-in and fan-out. [2]

Q. 7. What is the difference between Asynchronous and synchronous counters ? [2]

Q. 8. How does a decoder differ from an encoder ? [2]

Q. 9. Explain the difference between SOP and POS forms. [2]

Q. 10. Express the number $(137)_{10}$ in BCD and binary. [2]

Part–B

5×4=20

Q. 1. What is the necessary condition for a weighted code to be self- complementing ? Give two examples of weighted codes. [4]

Q. 2. Simplify the following equation using the K-mapping procedure : [4]

$$X = \bar{A}\bar{B}\bar{D} + A\bar{C}\bar{D} + \bar{A}B\bar{C} + AB\bar{C}D + A\bar{B}C\bar{D}$$

Q. 3. Convert the following number into the respective index given : [4]

(a) $(89)_{10} = (\;)_2 = (\;)_{16}$

(b) $(101.10101)_2 = (\;)_8 = (\;)_{10}$

Q. 4. Explain in detail the working of Finite state machines. [4]

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Q. 5. Prove the following identities using Boolean algebra and DeMorgan's theorems :

(a) $\overline{AB + BC + CA} = \bar{A}\bar{B} + \bar{B}\bar{C} + \bar{C}\bar{A}$ [4]

(b) $AB + \overline{AC} + A\bar{B}C(AB + C) = 1$

Q. 6. Describe a simple four-line multiplexer with a Logic Diagram. [4]

Q. 7. Describe the advantages and disadvantages of ECL. Why is ECL faster than TTL ? [4]

Part–C

3×10=30

Q. 1. Draw the logic circuit for the following equations. Simplify the equations and draw the simplified logic circuits : [10]

(a) $V = AC + ACD + CD$

(b) $W = (BCD + C)CD$

(c) $X = (B + D)(A + C) + ABD$

(d) $Y = AB + BC + ABC$

(e) $Z = ABC + CD + CDE$

Q. 2. Simplify the Boolean function $F(W, X, Y, Z) = \Sigma m(1, 3, 7, 11, 15)$ and the don't-care conditions $d(W, X, Y, Z) = \Sigma m(0, 2, 5)$. [10]

Q. 3. Discuss the detailed procedure for the analysis of combinational circuits. [10]

Q. 4. Explain the noise margin and figure of merit of a logic family. List the differences between the TTL logic family and the MOS family. [10]

Q. 5. Explain the different types of flip flops along with their truth table. [10]

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