Code No: R5210504

| **R5** |

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Generate Hamming code for the given 11 bit message 10010110101 and rewrite the entire message with Hamming code.
   (b) The binary numbers listed have a sign bit in the left most position and , if negative numbers are in 2's complement form. Perform the arithmetic operations indicated and verify the answers. [8+8]
       i. 101011 + 111001
       ii. 001111 + 110010
       iii. 111001 - 011010
       iv. 101111 - 100110.

2. (a) Write short notes about the various digital logic families.
   (b) Obtain the complement of the following Boolean expressions.
       i. AB + A(B + C) + B'(B + D)
       ii. A + B + A'B'C.
   (c) Obtain the dual of the following Boolean expressions. [8+4+4]
       i. A'B + A'BC' + A'BCD + A'BC'D'E
       ii. ABEF + ABE'F' + A'B'EF.

3. (a) Construct K-map for the following expression and obtain minimal SOP expression. Implement the function with 2-level NAND -NAND form.
   $f(A, B, C, D) = (A + C + D)(A + B + D)(A + B + \overline{C})(\overline{A} + B + \overline{D})(\overline{A} + B + \overline{D})$
   (b) Implement the following Boolean function F using the two - level form: [8+8]
       i. NAND-AND
       ii. AND-NOR $F(A, B, C, D) = \Sigma 0, 1, 2, 3, 4, 8, 9, 12$

4. (a) Implement 64 × 1 multiplexer with four 16 × 1 and one 4 ×1 multiplexer. (Use only block diagram).
   (b) A combinational logic circuit is defined by the following Boolean functions.
   $F_1 = \overline{ABC} + AC$
   $F_2 = A\overline{BC} + \overline{A}B$
   $F_3 = A\overline{B}C + AB$
   Design the circuit with a decoder and external gates. [8+8]

5. (a) Draw the circuit diagram of positive edge triggered D- flip-flop with NAND gates and explain its operation using truth table.
   (b) Write an HDL behavioural description of a D- flip-flop and D- flip-flop with synchronous preset and clear. [8+8]

6. (a) Design a 4-bit ring counter using T- flip flops and draw the circuit diagram and timing diagrams.
   (b) Draw the block diagram and explain the operation of serial transfer between two shift registers and draw its timing diagram. [8+8]

7. (a) Give the HDL code for a memory read , write operations if the memory size is 64 words of 4 bits each. Also explain the code
   (b) Obtain the 15-bit Hamming code for the 11-bit data word 11001001010. [8+8]

8. (a) i. Explain the difference between asynchronous and synchronous sequential circuits.
       ii. Define fundamental-mode operation.
       iii. Explain the difference between stable and unstable states.
       iv. What is the difference between an internal state and a total state.
   (b) Explain critical and non critical races with the help of examples. [8+8]

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