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B. Tech 3rd Semester Examination

Digital Electronics (N.S.)

EC-211

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, select one question from each sections A, B, C and D. Section E is compulsory.

SECTION - A

1. (a) A transmitter uses a single error correcting code for the message using even parity. The message received at the receiving end is 1110101. Check and correct the error. Assume the parity code is even. **(4)**

   (b) Convert the following numbers into decimal:

   (i) 100100111000.0111 (BCD) (ii) $(11001101.111)_2$

   (iii) $(CF.5)_{16}$ (iv) $(234)_5$ **(4)**

   (c) Simplify the expression:

   $Y(ABCD) = (\overline{A} + B)\,(A + B + D)\overline{D}$ **(4)**

   (d) Perform the following subtraction using 2's compliment method:

   (i) (0011.1001)-(0001.1110) (ii) $(3F)_{16}$-$(5C)_{16}$ **(4)**

   (e) Represent the number $(+46.5)_{10}$ as a floating point binary number with 24 bits. The normalized fraction mantissa has 16 bits and exponent has 8 bits. **(4)**

2. (a) Determine the single error correcting code for the message code (11010). Assume parity code is odd. **(4)**

(b) Perform the following subtraction using 1's compliment method: **(4)**

(i) $(11010)_2 - (10000)_2$ (ii) $(1000100)_2 - (1010100)_2$

(c) Simplify the following expression:

(i) $Y(A,B,C) = ABC + A\overline{B} + AB\overline{C}$

(ii) $Y(A,B,C,D) = ACD + \overline{A}BCD$ **(4)**

(d) What is Gray code? Give the advantages of Gray code over binary code. Write the Gray code for 4 bit binary number. **(4)**

(e) For the function given below

$f = \overline{A}\,\overline{B}D + AB\overline{C}\,\overline{D} + BCD$

(i) Express f in standard SOP form

(ii) Realize f using NAND gates only **(4)**

SECTION - B

3. (a) Reduce the following function using K-map technique and implement using NOR gates.

$Y(A,B,C,D) = \prod M(0,1,2,3,8,9,10,11,12,13)$ **(5)**

(b) Minimize the following Boolean function using K-maps:
$Y(A,B,C,D,E) = \Sigma m(0,1,5,6,9,13,14,17,21,22,25,29)$ **(5)**

(c) Simplify the following Boolean function using Quine-McCluskey method.

$Y(A,B,C,D) = \Sigma m(1,2,3,5,9,12,14,15) + d(4,8,11)$ **(5)**

(d) Define the following parameters of logic families and give their typical values for a standard TTL gate:

(i) Propagation delay (ii) Fan-out

(iii) Noise margin (iv) Figure of merit **(5)**

4. (a) Reduce the following function using K-map technique and implement using NAND gates:

$Y(A,B,C,D) = \overline{A}\,\overline{B}D + AB\overline{C}\,\overline{D} + BCD$ **(5)**

(b) Simplify the following four variable Boolean function using Quine-McCluskey method.

$Y(A,B,C,D) = \Sigma m(1,3,5,10,11,12,13,14,15)$ **(5)**

(c) Simplify the following functions:

$Y(A,B,C,D) = \Sigma m(1,3,7,11,15) + d(0,2,4)$ **(5)**

(d) Explain interfacing of a TTL gate driving CMOS gates and vice versa. **(5)**

SECTION - C

5. (a) Implement a full adder using two 4:1 multiplexers. **(5)**

(b) What is race around condition in J-K flip-flop? How it can be eliminated. **(5)**

(c) Explain the working of asynchronous up-down counter. **(5)**

(d) Explain the working of bidirectional shift register. **(5)**

6. (a) Implement the following functions using 3-to-8-line decoder:

(i) $Y_0(A,B,C) = \Sigma m(0,1,5,6)$

(ii) $Y_1(A,B,C) = \Sigma m(0,4,5,7)$ **(5)**

(b) Draw the logic circuit of J-K flip-flop and T flip-flop. **(5)**

(c) Explain the working of 4-bit synchronous counter. **(5)**

(d) What do mean by register? Also explain its different types. **(5)**

SECTION - D

7. (a) What is the need of A/D and D/A converter? List all D/A converters and explain. **(10)**

(b) Explain the following:

(i) PLA (ii) Sequential memories **(10)**

8. (a) Give different specifications of A/D and D/A converters. **(10)**

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(b) What do you understand by semiconductor memories? Give its classification and organisation. **(10)**

SECTION - E

9. (a) Divide the binary number 110111 by 11. **(1)**

(b) Find decimal equivalent of $(01010011)_2$ binary number. **(1)**

(c) Write the dual of the Boolean theorem A*(B+C) = AB+AC **(1)**

(d) A full adder can be implemented with half adders and OR gates. How many half adders and OR gates are required for a 4-bit parallel full adder without any initial carry? **(1)**

(e) How many flip-flops required to build Mod-15 counter? **(1)**

(f) The Q output of J-K flip-flop is 1. The output does not change when a clock pulse is applied. What will be the input J and K? **(1)**

(g) Write the minimum number of NAND gates required to implement $A + A\bar{B} + A\bar{B}C$ **(1)**

(h) Why does the ECL family have the lowest propagation delay of all logic families? **(2)**

(i) Encode the $(1011)_2$ binary word into 7-bit even parity hamming code. **(2)**

(j) What are the different types of hazards in asynchronous circuits? **(2)**

(k) Explain the basic flip-flop circuit for R-S using NOR gates. **(2)**

(l) What is the difference between truth table and excitation table? **(2)**

(m) What do you mean by sign-magnitude representation? **(2)**

(n) Determine the value of base $(193)_x = (623)_8$ **(1)**