NATIONAL INSTITUTE OF TECHNOLOGY, ROURKELA

B.Tech 4th Semester Med-semester Examination Feb-2011

Digital Electronics (EC202)

Total Marks: 3(

Duration: 2hr:

Instruction:

Answer All the Questions (Right hand margin indicates the marks)

1. Answer the following   [1x5]

   a. Convert the Gray code *10111* into binary digits.

   b. Implement $f = (x_1 x_2)' + x_1 + (x_2 + x_3)'$ using NAND gates.

   c. Implement $f = (x_1 + x_2)(x_2 + x_3)(x_1 + x_3)$ using NOR gates.

   d. What is the *10's* complement of $(0.3267)_{10}$?

   e. Give a Boolean expression of function f, when f is a *1* only if x_1, x_2 and x_3 are all *1* or if only one of the variables is a *0*.

2. Obtain the minimal sum of products expression for the following expression for the following function and implement the same using universal gates.   [5]

   $f = \sum_m (0, 2, 3, 5, 7, 8, 13) + \sum_m (1, 6, 12)$

3. A combinational switching network has four inputs x_1, x_2, x_3 and x_4 and one output f. The output is to be `0', if the input condition is a valid binary coded decimal (BCD) number. If any other combination of input is given, the output is to be `1'. Design the network using basic gates.   [5]

4. Simplify the following using Boolean algebra method   [1.5 + 1.5 + 2]

   (i) $f = (x_2 + x_2 x_3)(x_2 + x_2' x_3)(x_2 + x_4)$

   (ii) $f = x_1' x_2' x_3 + x_2 x_3 + x_1 x_3$,

   (iii) Obtain the canonical sum of products of $f = x_1 x_2 x_3 + x_1 x_3 x_4 + x_1 x_2' x_4$.

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5. Using K-map method, obtain the minimal sum of product expression of the following function. Specify the prime implicants, essential prime implicants and the cost of the circuit?

[3.5 + 1.

$f(x_1, x_2, x_3, x_4, x_5) = \sum_m (0, 2, 5, 7, 9, 11, 13, 15, 16, 18, 21, 23, 25, 27, 29, 31)$

6. a) Design a 4-to-1 multiplexer, whose function output f is given as

[2 +

$$f = \begin{cases} x_1, & \text{if } s = 0 \\ x_2, & \text{if } s = 1 \end{cases}$$

x_1 and x_2 are two of the inputs and s is the control signal.

b) Realize the VHDL code for the above multiplexer.