EE1005 – Digital Logic Design
Quiz# 3

SOLUTION MANUAL

Q: An **M-bit** thermometer code for the number **k** consists of (**k**) **1's** in the least significant bit positions and **(M – k) 0's** in more significant bit positions. A binary-to-thermometer code converter has **N inputs** and $\mathbf{2^N - 1}$ **outputs**. It produces a 2^N - 1 bit thermometer code for the number specified by the input. Design a combinational circuit for binary-to-thermometer code converter provided the number of inputs = 3 by finding the following:

Marking Criteria:

Inputs/Outputs : 1 mark

Truth Table: 5 marks

Equations: 4 marks

Circuit Diagram: 5 marks

Note: Incase truth table is wrong, question will receive 0 marks. (Binary Checking)

Those who tried to attempt it a little and got 1-2 values wrong , they may receive partial marks for the truth table.

No of Inputs: **3** **No of Outputs**: $2^3 - 1 = 7$ **(1 marks)**

Truth Table: **(5 marks)**

From the definition above, we can fill the truth table. 0 will have zero 1s, 1 will have one 1s starting from the least significant bit, 2 will have two 1s and so on and so on.

Decimal Digit	Inputs			Outputs						
	B2	B1	B0	T6	T5	T4	T3	T2	T1	T0
0	0	0	0	0	0	0	0	0	0	0
1	0	0	1	0	0	0	0	0	0	1
2	0	1	0	0	0	0	0	0	1	1
3	0	1	1	0	0	0	0	1	1	1
4	1	0	0	0	0	0	1	1	1	1
5	1	0	1	0	0	1	1	1	1	1
6	1	1	0	0	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1

Equations: **(1.75 each = 4 marks)**

Using k-maps to obtain the following equations, one is done rest was similar too.

T4

B2 \ B1 B0	00	01	11	10
0	0	0	0	0
1	0	1	1	1

B1 (columns 11, 10); B2 (row 1); B0 (columns 01, 11)

From k map: T4 = B2.B0 + B2.B1 **Similarly,**

T6 = B2.B1.B0

T5 = B2.B1 $T_5 = 1, iff\ B_2 = 1\ , B_1 = 1$

T3 = B2 T_3 only depends on B_2

T2 = B2 + B1.B0

T1 = B2 + B1

T0 = B2 + B1 + B0

Circuit Diagram: **(5 marks)**