Rajshahi University of Engineering & Technology

Department of Electrical & Computer Engineering

LAB REPORT

- ❖ **Course title** : **Digital Techniques sessional**
- ❖ **Course Code** : **ECE-2112**
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Experiment no.: 04

Name of the Experiment: Application of BCD to 7 segment display decoder.

Theory: The 7-segment display, also written as "seven segment display", consists of seven LEDs (hence its name) arranged in a rectangular fashion as shown. Each of the seven LEDs is called a segment because when illuminated the segment forms part of a numerical digit (both Decimal and Hex) to be displayed.

An additional 8th LED is sometimes used within the same package thus allowing the indication of a decimal point, (DP) when two or more 7-segment displays are connected to display numbers greater than ten.

Each one of the seven LEDs in the display is given a positional segment with one of its connection pins being brought straight out of the rectangular plastic package. These individually LED pins are labelled from a through to g representing each individual LED. The other LED pins are connected and wired to form a common pin.

So, by forward biasing the appropriate pins of the LED segments in a particular order, some segments will be light, and others will be dark allowing the desired character pattern of the number to be generated on the display. This then allows us to display each of the ten decimal digits 0 through to 9 on the same 7-segment display.

Truth Table:

DIGITS	INPUT A	INPUT B	INPUT C	INPUT D	OUTPUT a	OUTPUT b	OUTPUT c	OUTPUT d	OUTPUT e	OUTPUT f	OUTPUT g
0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	0	1	1	0	0	0	0
2	0	0	1	0	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	0	0	1
4	0	1	0	0	0	1	1	0	0	1	1
5	0	1	0	1	1	0	1	1	0	1	1
6	0	1	1	0	1	0	1	1	1	1	1
7	0	1	1	1	1	1	1	0	0	0	0
8	1	0	0	0	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	1	0	1	1

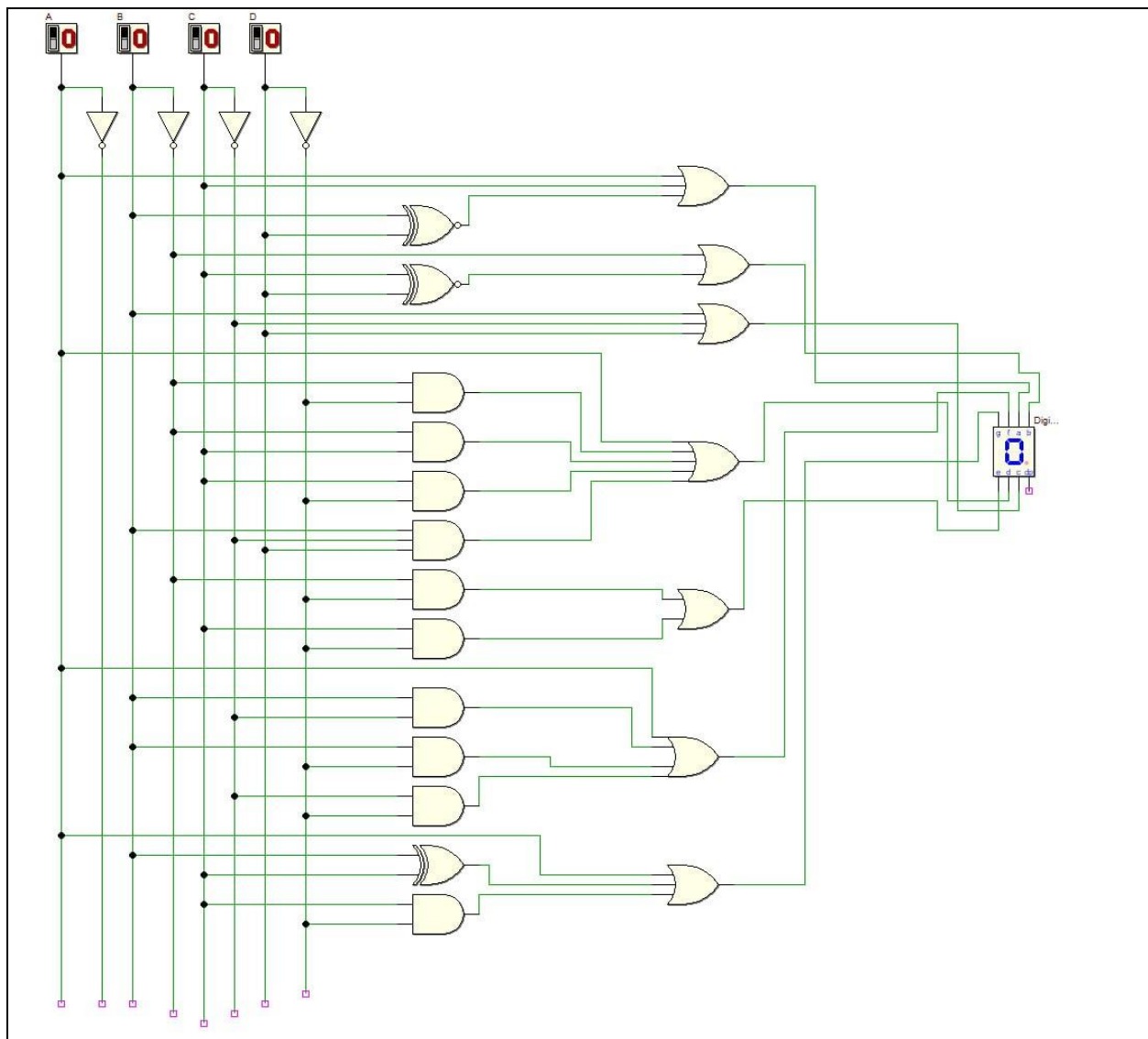Circuit Diagram:

Fig. BCD to 7-Segment Display Decoder

Code:

Verilog Code:

```verilog
module BCD7Segment(
    input [3:0] bcd,  // 4-bit BCD input
    output reg [6:0] seg // 7-segment display output (abcdefg)
);

always @(*) begin
    case (bcd)
        4'b0000: seg = 7'b0000001; // 0
        4'b0001: seg = 7'b1001111; // 1
        4'b0010: seg = 7'b0010010; // 2
        4'b0011: seg = 7'b0000110; // 3
        4'b0100: seg = 7'b1001100; // 4
        4'b0101: seg = 7'b0100100; // 5
        4'b0110: seg = 7'b0100000; // 6
        4'b0111: seg = 7'b0001111; // 7
        4'b1000: seg = 7'b0000000; // 8
        4'b1001: seg = 7'b0000100; // 9
        default: seg = 7'b1111111; // Blank display for invalid
BCD (10-15)
    endcase
end

endmodule
```

```
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
```

Verilog TestBench Code:

```
1
2
3
4
5
```

```verilog
module TestBench;
    reg [3:0] bcd;
    wire [6:0] seg;

    BCD7Segment uut ( .bcd(bcd), .seg(seg) );
```

```verilog
 6
 7            initial begin
 8                $monitor("BCD: %b, Segment Output: %b",
 9      bcd, seg);
10
11                bcd = 4'b0000; #10; // 0
12                bcd = 4'b0001; #10; // 1
13                bcd = 4'b0010; #10; // 2
14                bcd = 4'b0011; #10; // 3
15                bcd = 4'b0100; #10; // 4
16                bcd = 4'b0101; #10; // 5
17                bcd = 4'b0110; #10; // 6
18                bcd = 4'b0111; #10; // 7
19                bcd = 4'b1000; #10; // 8
20                bcd = 4'b1001; #10; // 9
21                bcd = 4'b1010; #10; // Invalid (should be
22      blank)
23                $stop;
24            end
25        endmodule
26
```

Output:

BCD: 0000, Segment Output: 0000001   // Display 0

BCD: 0001, Segment Output: 1001111   // Display 1

BCD: 0010, Segment Output: 0010010   // Display 2

BCD: 0011, Segment Output: 0000110   // Display 3

BCD: 0100, Segment Output: 1001100   // Display 4

BCD: 0101, Segment Output: 0100100   // Display 5

BCD: 0110, Segment Output: 0100000   // Display 6

BCD: 0111, Segment Output: 0001111   // Display 7

BCD: 1000, Segment Output: 0000000   // Display 8

BCD: 1001, Segment Output: 0000100   // Display 9

BCD: 1010, Segment Output: 1111111   // Blank

Discussion: The display consists of seven segments, each of which is a "6-sided box" made of two thin pieces of metal, typically aluminum. Additionally, the parts are positioned at a right angle. A 7-segment display's individual numerals are built of light-emitting diodes. By turning on specific LEDs it can generate numbers on display.