Reg. No.											

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

III SEM B.Tech (BME) DEGREE MAKE-UP EXAMINATIONS, DEC/JAN 2018-19

SUBJECT: DIGITAL ELECTRONICS (BME 2103)
(REVISED CREDIT SYSTEM)
Saturday, 29th December, 2018, 9 to 12 Noon

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to Candidates:

1. Answer ALL questions.
2. Draw near labeled diagrams wherever necessary.

1A. Design a Moore sequential circuit using D Flip-flops, which detects an overlapping sequence 101 from an input sequence. 05

1B. (i) Design a divide-by-10 ripple counter using suitable Flip-flops that trigger on the negative edge. Illustrate the working using the timing diagram. 05

(ii) If the output frequency of the above counter is 7kHz, what is its input frequency?

2A. Design a 3-bit counter which counts in the sequence: 05

001, 011, 010, 110, 111, 101, 100, (repeat) 001,…. using JK Flip-flops.

2B. (i) Perform the addition of the following BCD numbers: 05

(a) 0110 0111 and 0101 0011, (b) 0100 0100 1000 and 0100 1000 1001

(ii) Realize a one digit BCD adder using 7483 ICs. Describe how the BCD adder circuit detects the need for a correction and executes it.

3A. (i) What range of decimal values can be represented by a 3-digit hex number? 04

(ii) Solve the following equation for X: $X_{16} = 1010\ \ 0000\ \ 1011\ \ 0101_2$

(iii) The binary equivalent of 0.6875_{10} is:

(iv) Write the BCD bits required to drive a 3-digit digital thermometer, to display the temperature 159^{o}.

3B. Design a decoder/driver circuit for the common cathode type of 7-segment display, to display the decimal numbers from 0 to 7. 06

4A. (i) Find the simplified Boolean expression using Karnaugh map for the following Boolean function. Also, write the simplified expression without using don't cares, and compare both the simplified expressions. 07

$$f(w,x,y,z) = \sum m\,(0,2,4,6,8) + \sum d\,(10,11,12,13,14) \qquad d \rightarrow don't\ cares$$

(ii) Obtain the minimum sum-of-products expression using Karnaugh map for the following five-variable Boolean expression.

$$y = \bar{A}\bar{B}\bar{C}\bar{D}E + \bar{A}\,\bar{B}\,C\bar{D}E + \bar{A}\bar{B}\bar{C}DE + \bar{A}\bar{B}CDE + \bar{A}BC\bar{D}\bar{E} + \bar{A}B\bar{C}\bar{D}\bar{E} + A\bar{B}\bar{C}\bar{D}E + A\bar{B}\bar{C}DE + A\bar{B}C\bar{D}E + A\bar{B}CDE$$

4B. Simplify the following expressions using Boolean algebra techniques and Demorgan's theorems. 03

(a) $(A+B)\left[\overline{\bar{A}(\bar{B}+\bar{C})}\right] + \bar{A}\bar{B} + \bar{A}\bar{C}$

(b) $\overline{\overline{A\bar{B}} + \overline{ABC}} + A(B + A\bar{B})$

5A. Realize the following Shift Registers using D Flip-flops. 05

(a) 2-bit Parallel-in Serial-out (PISO) / Parallel-in Parallel-out (PIPO) Shift Register

(b) 2-bit Serial-in Serial-out (SISO) / Serial-in Parallel-out (SIPO) Shift Register

5B. Design a 3-bit binary to gray code converter using each of the following: 05

(a) 4:1 MUXs, and (b) 3 to 8 line decoder