UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: DMT 2063
COURSE	: DIGITAL SYSTEM
SEMESTER/SESSION	: 2-2022/2023
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 8 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) Electronic system can be divided into two broad categories which is digital and analog. Answer the followings question.

i. Define analog and digital signal. (2 marks)

ii. Draw the waveform of analog and digital signal. (2 marks)

b) List **TWO (2)** types of number system used in digital signal. (2 marks)

c) Convert the following number systems to hexadecimal number. Write your answers up to two decimal places and shows the working method.

i. 198.33_{10} (4 marks)

ii. 1001010.11001_2 (4 marks)

d) Convert 147_{10} into:

i. Binary number (2 marks)

ii. Binary coded decimal (BCD) (2 marks)

e) Based on Figure 1, answer the following questions, produce the:

i. Boolean expression for output Y. (3 marks)

ii. Truth table for the logic circuit. (4 marks)

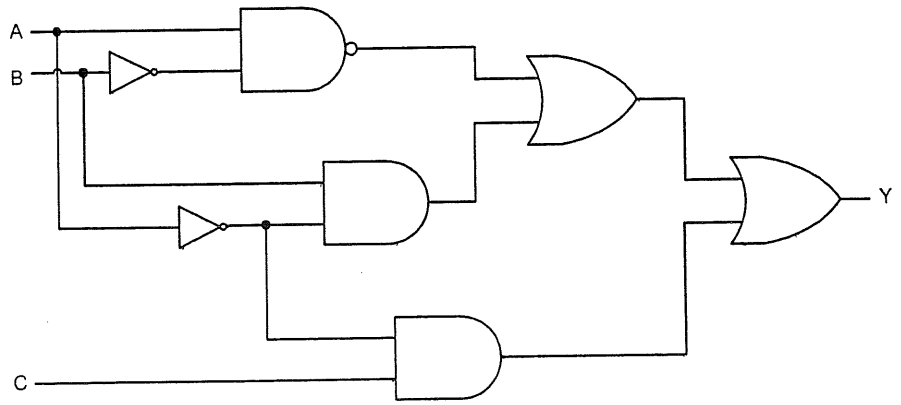

Figure 1

QUESTION 2

a) Answer the following questions:

i. Draw the logic symbol for NAND gate. (1 mark)

ii. Produce the truth table for NAND gate. (2 marks)

b) A simple electronic lock is develop using logic gate. The lock will open (logic 1) only when two combination of switches (A,B and C) are activated (logic 1). Answer the following questions.

i. Produce the truth table. (4 marks)

ii. Produce the standard sum-of-products (SOP) expression. (3 marks)

iii. Illustrate the logic circuit. (3 marks)

c) For the Boolean expression below.

$$X(D,E,F,G) = DF + \bar{D}EFG + D\bar{E}F + \bar{E}FG$$

i. Produce the standard sum-of-products (SOP) expression for output X. (4 marks)

ii. Produce the simplified output expression X using K-Map. (5 marks)

iii. Illustrate the logic circuit for the simplified Boolean expression obtained in 2c(ii). (3 marks)

QUESTION 3

a) Refer to Figure 2(i). Complete the output timing diagram, Z in Figure 2(ii) with A and B as the input signal. (Answer this question in the given answer booklet)

(4 marks)

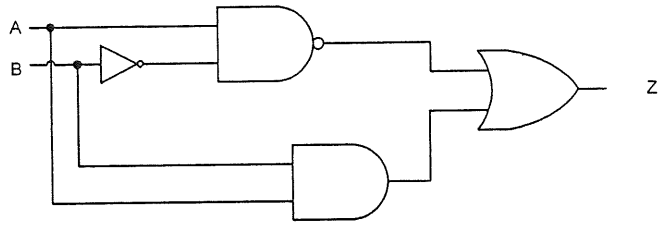

Figure 2(i)

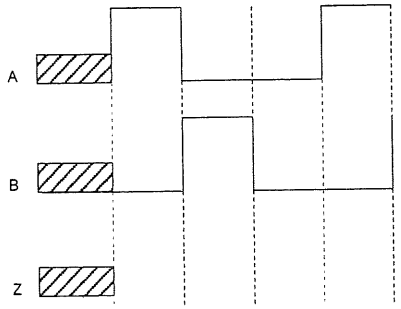

Figure 2(ii)

b) Implement the Boolean expression of $F(A,B,C)=\sum m(0,2,5,6)$ using 4 to 1 multiplexer. (6 marks)

c) A system has three inputs A, B, and C. This system will produce HIGH output Y, only if the inputs (A, B, C) are less than two or greater than six.

i. Produce the truth table for the given condition. (4 marks)

ii. Produce the standard SOP expression from the truth table in question 3c(i). (3 marks)

iii. Produce the simplified SOP expression using K-map (4 marks)

iv. Illustrate the logic circuit based on the simplified Boolean expression obtained in question 3c(ii). (4 marks)

QUESTION 4

a) List **THREE (3)** advantages of digital system (3 marks)

b) Draw movement of data for parallel in serial out (PISO) shift register. (2 marks)

c) List **TWO (2)** types of logic circuit (2 marks)

d) Figure 3 shows a logic symbol for JK Flip Flop. Complete the timing diagram in Figure 4 by drawing the output waveform of signal Q. (5 marks)

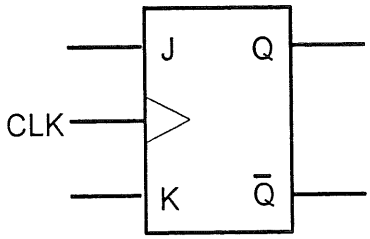

Figure 3

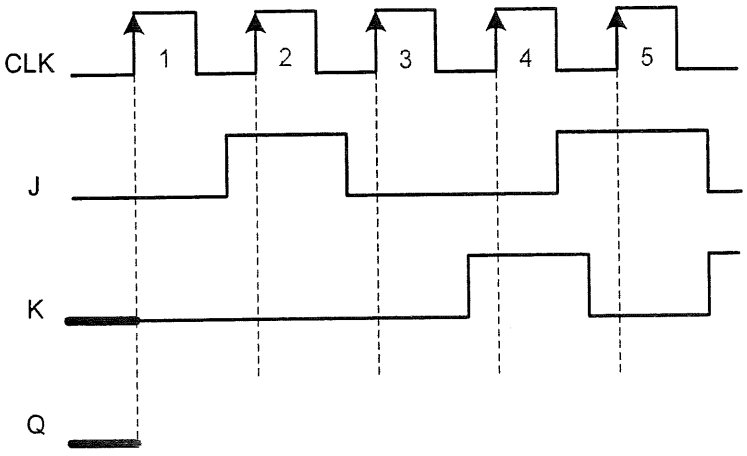

Figure 4

e) A synchronous counter with counting sequence as shown in Figure 5 is designed by using JK flip-flops. Assume all unused states are forced to don't care condition.

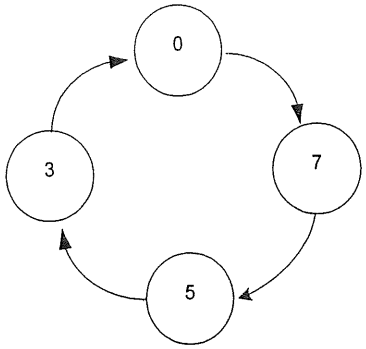

Figure 5

i. Complete the excitation table in Table 1. (4 marks)

ii. Produce the simplified Boolean equation for JA, KA, JB, KB, JC and KC by using K-map. (6 marks)

iii. Draw logic circuit based on the simplified Boolean expression obtained in question 4e(ii) using positive edge triggered JK flip-flop circuit with active high clock and other suitable logic gates. (3 marks)

Table 1

PRESENT STATE	NEXT STATE	J_A	K_A	J_B	K_B	J_C	K_C
A B C	A' B' C'						
0 0 0							
0 0 1							
0 1 0							
0 1 1							
1 0 0							
1 0 1							
1 1 0							
1 1 1							

----------End of Question----------

APPENDIX

Table 1: Rules of Boolean Algebra

1. $A + 0 = A$	7. $A \cdot A = A$
2. $A + 1 = 1$	8. $A \cdot \overline{A} = 0$
3. $A \cdot 0 = 0$	9. $\overline{\overline{A}} = A$
4. $A \cdot 1 = A$	10. $A + AB = A$
5. $A + A = A$	11. $A + \overline{A}B = A + B$
6. $A + \overline{A} = 1$	12. $(A + B)(A + C) = A + BC$

De Morgan Theorem

$$\overline{X \cdot Y} = \overline{X} + \overline{Y}$$

$$\overline{X + Y} = \overline{X} \cdot \overline{Y}$$

$$\overline{X \cdot Y \cdot Z} = \overline{X} + \overline{Y} + \overline{Z}$$

$$\overline{X + Y + Z} = \overline{X} \cdot \overline{Y} \cdot \overline{Z}$$

Table 2: Excitation Table

<table>
<tr><th>Flip-Flop Name</th><th>Characteristic Table</th><th>Characteristic Equation</th><th>Excitation Table</th></tr>
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<td>SR</td>
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