FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY
SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

TRADE/DIPLOMA in ELECTRONICS ENGINEERING PROGRAMME
(INSTRUMENTATIONS and CONTROLS)
(TELECOMMUNICATIONS and NETWORKING)

EEE475 DIGITAL ELECTRONICS 1

FINAL EXAMINATION (TRIMESTER 3, 2017)

DATE/TIME/ROOM – Refer to Exam Timetable

INSTRUCTIONS TO CANDIDATES

1. You are allowed 10 minutes extra time during which you are not to write.
2. Write all your answers in the allocated Answer Booklet.
3. Begin each answer on a fresh new page and use both sides of the sheets.
4. Write your identification number on the top of each attached sheet.
5. Insert all written foolscaps, graph paper, drawing paper, etc in their correct sequence and secure with string provided.
6. For all sheets of paper in which has been done, cross it through and you must attach to your answer script.
7. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
8. Do NOT use calculators having the numbering system converters such as DEC-BIN, BIN-DEC, DEC-HEX, DEC-OCT, HEX-DEC & OCT-DEC.
9. All Sections A, B and C are compulsory however Section D is *optional* and do ***one only***.

Section A: (45 marks) *(Topics 1, 2, & 3)*

1. Relate the digital and analogue parameters, applications and definition to interpret the difference between analogue and digital techniques by answering the tabulated comparisons below:

*(Note: Write **only** the alphabets and answers in your answer booklet)*

	Analogue Technique	Digital Technique	Allocated Marks
Definition	(a)	(b)	(1 mark)
Speed (Process)	(c)	(d)	(1 mark)
Voltage (Comparison)	(e)	(f)	(1 mark)
Advantage (system design application)	(g)	(h)	(1 mark)

2. Determine the following numbering system equivalence by showing the workings:

(Note: You may use any method to resolve the answer)

a) $1111001101_2 =$ _____$_{10} =$ _____$_8 =$ _____$_{16}$ (6 marks)

b) $1FB2_{16} + 11101101_2 =$ _____$_8$ (4 marks)

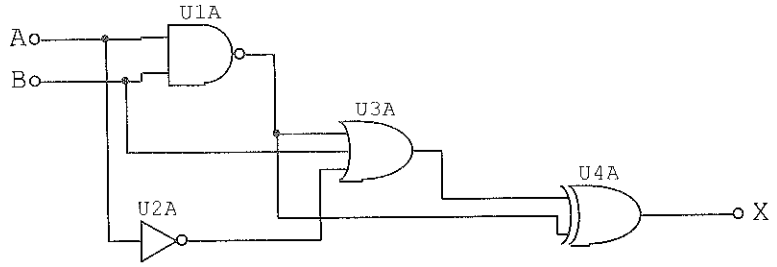
3. Using the ASCII table in Annex 1, determine the hexadecimal equivalent of EEE475 (3 marks)

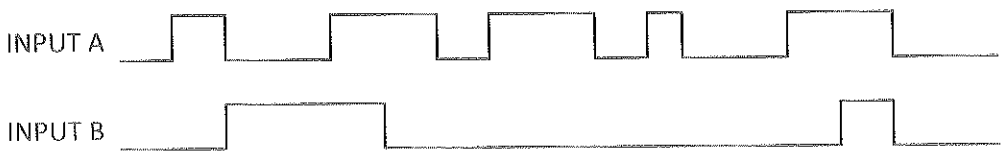
4. Determine the equivalent BCD codes of decimal numbers 0, 1, 4, 6, 8, 9. (3 marks)

5. Apply De-Morgan's Theorem by realization using the NAND Gates by sketching its equivalent logic diagram:
   a) $A + B$ (2 marks)
   b) $\bar{B}A + \bar{A}B$ (5 marks)

6. Determine the timing diagrams by sketching the outputs of the each gate:

(Note: Use Annex 2 timing diagram and attach to your answer booklet)





(10 marks)

7. Determine the simplified Boolean Expression using the karnaugh map:
   a) $B(Q, L, M, H) = \sum m\ (0, 2, 4, 6, 8, 10, 12, 14)$

   (5 marks)

   b) $X(A, B, C) = \Pi\ N\ (1, 3, 5, 7)$

   (3 marks)

Section B: (22.5 marks) *(Topics 4, 5, 6 & 7)*

1. Determine the maxterm groups by inspection

AB	00	01	11	10
00	0	1	X	1
01	0	1	X	1
11	1	0	X	X
10	1	1	X	X

(2.5 marks)

2. Apply the interpretation of demonstrating a combinational logic diagram by determining the Boolean SOP Expression and SOP logic diagram of the given truthtable:

INPUTS			OUTPUT
X_2	X_1	X_0	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

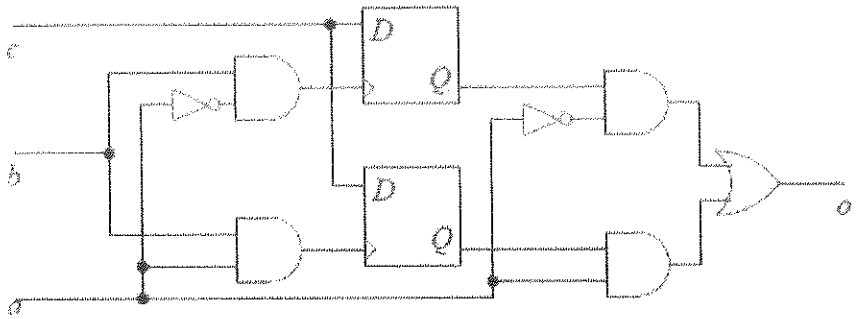
(5 marks)

3. Interpret design and analysis electronic design automation (EDA) software and breadboard implementation for the given Boolean Equation by speculating your explanation to how this is done.

$$Y = A\bar{B}C + \bar{A}B$$

(7 marks)

4. The logic diagram shown below incudes two d flipflops. Recall that a D flipflop's stored state remains unchanged as long as *set* = 0. At the instant that *set* switches to 1, its stored bit switches to *value*, and remains until set changes to 1 again.



Say a user enters the sequence of inputs given in the truthtable below, one after the other. Determine what the output of circuit will settle into after each of the user's input.

a	b	c	o
1	1	1	?
0	1	1	?
0	0	1	?
0	0	0	?
0	1	0	?
0	0	0	?
1	0	0	?

(8 marks)

Section C: (23.5 marks) *(Topic 8 & 9)*

1. Sketch and interpret the block diagram of an ADC/DAC by labelling the stages and interfacing stages.

   (6 marks)

2. A 5-bit DAC has a current output. For a digital input of 101000, an output current of 10mA is produced. Interpret, apply and determine I_{OUT} be for a digital input of 11101?

   (3 marks)

3. Assume the following values for the ADC clock frequency = 1MHz; VT = 0.1 mV; DAC has F.S. output = 10.23V and a 10-bit input. Determine the following values:
   a) The digital equivalent obtained for VA = 3.728V (3 marks)
   b) The conversion time (2 marks)
   c) The resolution of this converter (2 marks)

4. Determine the largest value of output voltage from an 8-bit DAC that produces 1.0 V for a digital input of 00110010? (Consider K as 20mV)

   (3.5 marks)

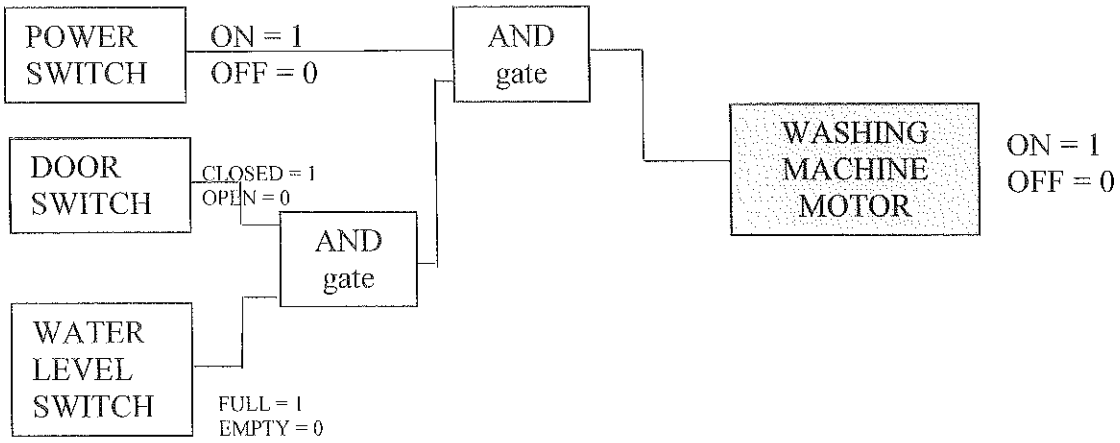
5. Sketch and label the seven segment display and circuit diagram to differentiate the two types.

   (4 marks)

Section D: (9 marks) *(Optional) (Apply, interpret, and demonstrate a design project)*

Choose *ONE* question only by writing the question number in your answer sheet and answer the following:

1. The diagram below shows a control system which may be fitted in an automatic washing machine;



a) What conditions will stop the washing machine working?

(3 marks)

b) Use a truthtable to depict this?

(6 marks)

2. In a certain chemical-processing plant, a liquid chemical is used in a manufacturing process. The chemical is stored in three different tanks. A level sensor in each tank produces a HIGH voltage when the level of chemical in the tank drops below a specified point.
Apply a circuit that monitors the chemical level in each tank and indicates when the level in any two of the tanks drops below the specified point.

(9 marks)

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