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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(ONLINE)  
SEMESTER I  
SESSION 2020/2021**

COURSE NAME : DIGITAL ELECTRONICS  
COURSE CODE : DAE 21203  
PROGRAMME CODE : DAE  
EXAMINATION DATE : JANUARY / FEBRUARY 2021  
DURATION : 4 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS  
OPEN BOOK EXAMINATION

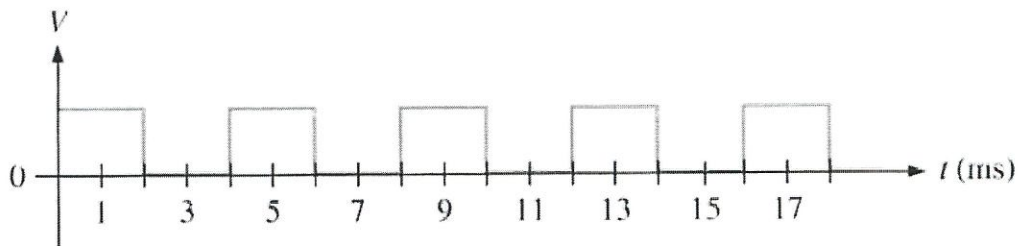
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THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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**Q1** (a) Explain the rise time and fall time of the pulse with aid of a diagram. (4 marks)

(b) A pulse waveform is shown in **Figure Q1(b)**.



**Figure Q1(b)**

(i) Briefly explain either the pulse waveform is periodic or non-periodic? (2 marks)

(ii) Determine the period, duty cycle and frequency of the waveform. (6 marks)

(c) A number is simply written as 1011101. Determine its values in decimal using bases 2, 8, 10 and 16. Show all your works. (7 marks)

(d) Perform the following arithmetic operations. Check the answer with its decimal equivalent.

(i)  $0010_2 + 1010_2 + 0111_2$  (2 marks)

(ii)  $01100101_2 + 11010100_2$  (2 marks)

(iii)  $3AE_{16} - 2C7_{16}$  (2 marks)

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**Q2** (a) Given Boolean expression of:

$$X = (A + BC)(\bar{B} + \bar{C})$$

- (i) Draw the logic circuit for the expression. (3 marks)
- (ii) Obtain the truth table for the logic circuit showing all inputs and outputs A, B and C. (5 marks)

(b) A logic circuit with three inputs (A,B,C) will have an output (Y) that goes LOW only when A is HIGH while B and C are different.

- (i) Construct the truth table for this logic circuit (4 marks)
- (ii) Write the output expression in sum of minterms. (2 marks)
- (iii) Simplify the output expression using Boolean theorem and compare with the Karnaugh Map method. (6 marks)
- (iv) Draw the circuit using logic gates from the simplified expression. (5 marks)

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Q3 (a) Based on the circuit in **Figure Q3(a)**,

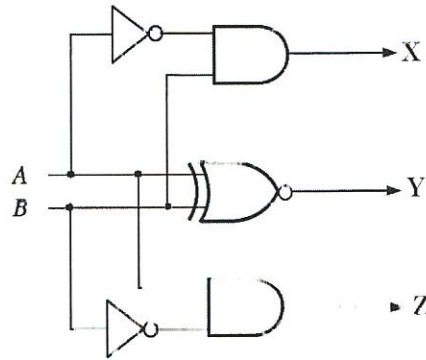


Figure Q3(a)

- (i) Write the Boolean Expression for outputs X, Y and Z. (6 marks)
- (ii) Obtain the truth table showing all inputs and outputs. (6 marks)

(b) Based on logic circuit in **Figure Q3(b)**,

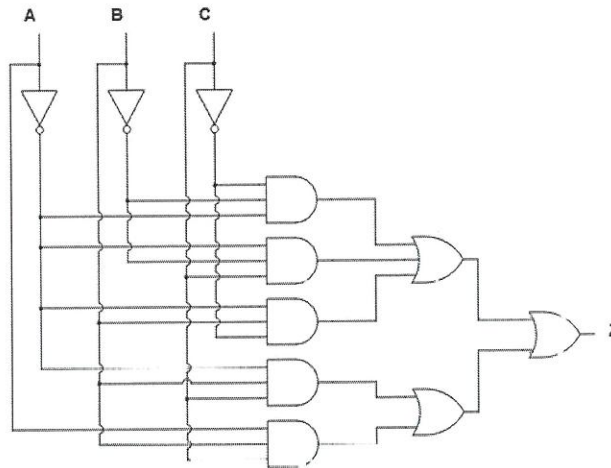


Figure Q3(b)

- (i) Determine the Boolean expression of Z. (3 marks)
- (ii) Simplify the expression from **Q3(b)(i)** using multivariable theorem and/or DeMorgan theorem. (5 marks)
- (iii) Implement the simplified expression using NAND gates only. (5 marks)

**Q4** (a) For the following function:

$$F(W, X, Y, Z) = \sum(0,5,7,8,10,13,15) + d(2,3,4)$$

- (i) Build the truth table. (3 marks)
- (ii) Simplify using a Karnaugh map (3 marks)
- (iii) Obtain the minimum sum of product (SOP) expression. (3 marks)
- (iv) Implement the simplified expression using basic logic gates. (3 marks)

(b) Design a system with four inputs, A, B, C and D and one output, F such that  $F = 1$  if three or more of the inputs are 1.

- (i) Build the truth table. (3 marks)
- (ii) Write the minterm expression for the F. (2 marks)
- (iii) Simplify the expression of F. (4 marks)
- (iv) Simplified Boolean expression in **Q4(b)(iii)** with NAND gates only. (4 marks)

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- END OF QUESTIONS -