NATIONAL OPEN UNIVERSITY OF NIGERIA
14-16 AHMADU BELLO WAY, VICTORIA ISLAND LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
MARCH/APRIL 2015 EXAMINATION
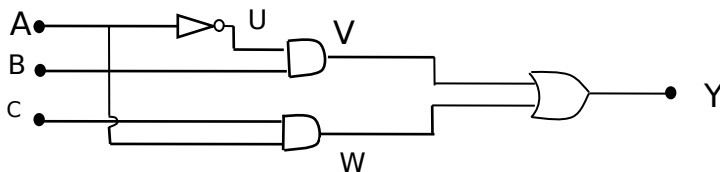
SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: **PHY 405**
COURSE TITLE: **Electronics III**
TIME: **3 Hours**

INSTRUCTION: Answer question 1 and any other four questions.

1. (a) (i) Draw a circuit diagram to show how the **OR** gate can be realized using two pn junction diodes.
                                                                                3 marks
 (ii) Draw the circuit symbol of the **NOR** gate and construct its truth-table   **4 marks**

   Use this circuit diagram for Q2

   (b) Use the circuit diagram shown to answer the following questions:
(i) Write down the outputs U, V, W and Y in terms of the inputs A and B.   **5 marks**
(ii) Construct the truth-table of the output Y in terms of the input A and B.   **2 marks**

   2. (a) (i) Convert the following to decimal number:
   $3BE.1A_{16}$; $(1011.101)_2$ **3 marks**
   (ii) Multiply 101101 by 110   **3 marks**
   (b) Use Boolean theorems to prove the following identities:
   (i) $A+\overline{A}B=A+B$ **4 marks**
   (ii) $(A+B)(A+C)=A+BC$ **4 marks**

3(a) (i) Draw a half-adder circuit and label its inputs and outputs.   **4marks**
(ii) Construct the truth table to illustrate the operation of the half-adder circuit   **4 marks**
(b)(i) Draw a digital circuit diagram of a two-bit binary adder.   **3 marks**
(ii) Mention two examples of universal gates and briefly state the reason why they are referred to as universal.   **3 marks**

4. (a) (i) Distinguish between combinational and sequential logic circuits and give one example of each.

3 marks

(ii) With a suitable circuit diagram, explain the working of a RS flip-flop constructed with two NAND gates.

4 marks

(b) (i) Draw the circuit diagram of the De Morgan equivalent of the NAND gate RS flip-flop.

3 marks

(ii) Construct the truth table for a positive edge triggered RS flip-flop   **4 marks**

5. (a) (i) Write the Boolean expression for the truth table given in Table Q5.1   **4 marks**

Table Q5.1:

A	B	C	Y
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

(ii) Design a digital circuit for $Y = \bar{A}C + A\bar{D}$ using AND, OR and NOT gates. **4 marks**

(b) (i) Design a digital circuit for question 5(a)(ii) using NAND gates only   **4 marks**

(ii) Distinguish between positive going transition PGT and negative going transition NGT as applied to edge triggered systems

2 marks

6. (a) (i) What is a register?   **2 marks**

(ii) Draw a circuit diagram of a buffer register and explain it working.   **5 marks**

(b) (i) What is a counter? What do you understand by the mod number of a counter?

3 marks

(ii) Design a mod 12 counter.   **4 marks**

7. (a) (i) Draw a pictorial representation of a general purpose CRT and label the components.

4 marks

(ii) If the time/div control is set to 2 μ s/div and the displayed signal covers 4 div on the horizontal scale of the CRT screen, determine the frequency of the signal.   **4 marks**

(b) (i) What is a function generator?   **3 marks**

(ii) Distinguish between the terms rise time T_r and fall time T_f as applied to signal generation.

3 marks