JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

UNIVERSITY EXAMINATION FOR THEDEGREE OF BACHELOR OF EDUCATION (SCIENCE)

3RD YEAR 2ND SEMESTER 2016/17

MAIN REGULAR

COURSE CODE: SCH 314

COURSE TITLE: DIGITAL ELECTRONICS

EXAM VENUE: PHY LAB **STREAM: (BED SCI)**

DATE: 06/09/16 **EXAM SESSION: 2.00 – 4.00 PM**

TIME: 2:00HRS

Instructions:

1. **Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

SECTION A

QUESTION 1

a. Draw the symbol of 4-input NOR gate and create its truth table (3 marks)

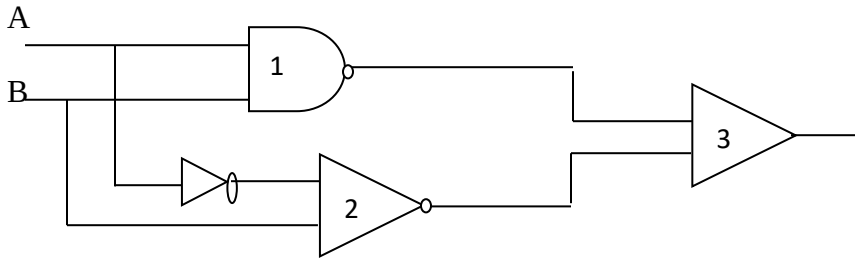
b. Given the Boolean function $Y = \left[(A+B)\left(\overline{A+C}\right)\right] + \left[\left(\overline{AC}\right)(B+C)\right]$

i) Draw the combinational logic circuit diagram for the function. (4 marks)

ii) Construct its truth table (4 marks)

iii) From the truth table deduce its logic operation (2 marks)

c. Find the Boolean expression for the logic circuit shown in the figure below and simplify it using Boolean algebra (4 marks)



d. Distinguish between discrete circuits and Integrated circuits (2 marks)

(e) Define the following parameters of logic families

i. Fan out

ii. Propagation delay

iii. Noise margin (3mks)

(ii)The CMOS logic family offers some significant advantages over bipolar logic family. Name any three (3mks)

SECTION B

QUESTION 2

(a) Calculate the values of the following unknowns

(i) $(13.375)_{10} = x_2$ (3mks)

(ii) $(82.25)_{10} = Q_{16}$ (3mks)

(iii) $(00101001.0111010)_{BCD} = Z_2$ (3mks)

(a) Perform the following subtractions using 2's complement method

(i) 01000 - 01001 (4 mks)

(ii) 01100 – 00011 (4 mks)

(b) Using one's complement, complete the following subtractions

11001 – 10110 (3 mks)

QUESTION 3

a. ICs can be classified according two distinct parameters, **the fabrication method** and **the integration scale**. Fully give the types of ICs as per these two parameters. (8 marks)
b. Give a detailed account of the following logic families, giving their schematic diagrams.
   i. TTL NAND gate with open collector output
   ii. CMOS inverter (8 marks)
c. Briefly explain the four types of TTL logic families (4marks)

QUESTION 4

a. Simplify the Boolean expressions below using Boolean theorems (6 marks)
b. Simplify the Boolean expressions below using Karnauph maps (6 marks)
c. State the DeMorgans theorems (4 marks)
d. Use DeMorgans theorems to simplify the Boolean expression below (4 marks)

QUESTION 5

a. One of the pilot's instructions in the manual reads: If chimney is not blocked and the house is cold and the pilot light is lit, then open the main fuel valve to start boiler.
   i. Draw a logic circuit diagram for this instruction using a desired gate
   ii. Write down its Boolean expression
   iii. Draw its Truth table. (10 marks)
b. Briefly distinguish between a digital signal and an analogue system (6 marks)
c. Draw an analogous electrical circuit for an AND gate (4 marks)