JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

UNIVERSITY EXAMINATION FOR THEDEGREE OF BACHELOR OF EDUCATION (SCIENCE)

MAIN

SPECIAL RESITS EXAMINATIONS   FEB 2022

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COURSE CODE: SPB 9320/SPH314

COURSE TITLE: DIGITAL ELECTRONICS 1

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

DATE: **EXAM SESSION:**

TIME: 2:00HRS
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1. **Instructions:** 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.

QUESTION ONE

a. Assume a radix-32 arbitrary number system with 0–9 and A–V as its basic digits.
   i) Write down the first 20 numbers in this system.   **2 marks**
   ii) Convert $(COVID19)_{32}$ of this number system to decimal   **3 marks**

b. In JOOUST, students pay tution fees based on the program one is enrolled for. PhD students pay highest, followed by Masters students and finally the Bachelors students who pay the least. Tree students paid fees that could be counted in other number systems as follows. Waithera KShs $BEEF_{16}$; Kipyegon KShs 777634_8; and Moraa KShs. 111001010111101_2. Classify these three students as per their program of study.
   (9 marks)

c. Draw the symbol of a 2-input XOR gate and create its truth table hence deduce its logic equation   **(3 marks)**

d. The following map is a Karnaugh map for a Boolean equation

	AB	AB	AB	AB
CD	1	0	0	1
CD	0	1	1	0
CD	0	1	1	0
CD	1	0	0	1

   i) Write down the unsimplified Boolean equation that was used to draw the Karnaugh map above
   ii) Write down the simplified form of the equation as per the Karnaugh map above.
   iii) Draw the logic gate combination that implements the simplified version above **(7 marks)**

f.   Implement an AND gate using NOR gates only   **(3 marks)**
g.   State and prove the two DeMorgans theorems using truth table   **(4 marks)**

QUESTION TWO

(a) Calculate the values of the following unknowns

    (i) $(27.375)_{10} = X_2$ **(2 marks)**

    (ii) $(100.25)_{10} = Q_{16}$ **(3 marks)**

(iii) $(00101001.0111010)_2 = M_8$ **(3 marks)**

        i) $(BABE.C001)_{16} = P_8$ **(3 marks)**

(b) Convert :

    (i) $(1001.0101)_2$ to BCD   **(3 marks)**

    (ii) $(137.21)_8$ to Excess-3 code   **(3 marks)**

    (iii) $(101001011100.1001)_{BCD}$ to Excess-3 code   **(3 marks)**

QUESTION 3

   a. Simplify the following logic equations using the Boolean theorems

      i. $Y = AB + A(B+C) + B(B+C)$ **(2 marks)**

      ii. $Y = \left[A\bar{B}(C+BD) + \bar{A}\bar{B} \right]C$ **(3 marks)**

      iii. $Y = \bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}C + ABC$ **(3 marks)**

   b. Simplify the following logic functions using De Morgans theorems

      i) $Q = \overline{\overline{A + B\bar{C}} + D\left(\overline{E + \bar{F}}\right)}$ **(3 marks)**

      ii) $R = \overline{\overline{\overline{A\bar{B}C} + \overline{ACD}} + B\bar{C}}$ **(3 marks)**

   c. Simplify the following using Karnauph maps technique

      i) $Y = \bar{A}BC + AB\bar{C} + A\bar{B}C + ABC$ **(3 marks)**

      ii) $Y = \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + \bar{A}BC\bar{D} + A\bar{B}CD + ABCD + \bar{A}BCD$ **(3 marks)**

QUESTION 4

   a. Draw the circuit diagrams of the following bipolar devices

        i.   DL,   ii. RTL,   iii. DTL   **(6 marks)**

   b. Draw the schematic circuit diagram of the standard transistor transit logic and explain how it works   **(8 marks)**

c. Briefly describe the following classes of MOS families
   i.   PMOS   ii. NMOS   iii. CMOS   **(6 marks)**

QUESTION 5

a. For a student to graduate from JOOUST he must satisfy ALL of the first three conditions AND ANY one of condition iv and v.
   i.   He must pass all the course units
   ii. He must clear the fee balance
   iii. He must undergo an industrial attachment or write down a research paper
   iv. He must not appear before the disciplinary committee for any indiscipline case
   v.   Her must be either a Muslim or a Christian

   Desighn a logic circuit diagram to implement the above set of rules (10 marks)

b. Digital Integrated circuits can be classified into five major classes. Name and briefly describe each class**.   (10 marks)**