OFFICE OF THE DEPUTY VICE CHANCELLORACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2023 /2024 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER REGULAR EXAM

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: PHY 322

COURSE TITLE: DIGITAL ELECTRONICS

DATE: 23RD, APRIL, 2024   **TIME: 2PM - 5PM**

INSTRUCTION TO CANDIDATES

- **SEE INSIDE**

THIS PAPER CONSISTS OF 3 PRINTED PAGES   PLEASE TURN OVER

MAIN EXAM
PHY 322: DIGITAL ELECTRONICS

STREAM: BED (Science)   DURATION:

INSTRUCTIONS TO CANDIDATES

   i.   *Answer **TWO** questions in section A and any other **THREE** questions in section B.*

SECTION A (28 MARKS)

Question One (14 Marks)

  (a) List three main ways of specifying the function of a combinational logic circuit (3 Marks)

  (b) With aid of a diagram explain the Static I-V Characteristics of a junction diode (7 Marks)

  (c) Distinguish between holes and free electrons in semiconductor physics (4 marks)

Question Two (14 Marks)

  (a) With aid of well labeled diagrams distinguish between analog and digital signal (4 marks)

  (b) State three advantages of presenting data using Digital Signals (3 Marks)

  (c) Convert 0110_2 into a decimal number. (2 Marks)

  (d) Convert the following hexadecimal numbers into equivalent octal numbers. (4 Marks)
    i) A72E

    ii) 4.BF85

  (e) What are Logic Gates? (1 Mark)

SECTION B (42 MARKS)

Question Three (14 Marks)

  (a) What are universal gates? (2 Marks)

  (b) List types of universal gates (2 Marks)

  (c) Define the term shift register. (2 Marks)

  (d) State the differences between a serial shift and a parallel shift register. (2 Marks)

(e) Contrast between combinational logic circuits and sequential logic circuits clearly stating all the differences with respect to their output, memory and fundamental building block. (6 Marks)

Question Four (14 Marks)

(a) Explain how a depletion layer is formed in a P-N junction (6 Marks)

(b) Explain the following Technical Characteristics of memory elements

    i.   Access time (1 Mark)

    ii.   Cycle time (1 Mark)

    iii.   Throughput (1 Mark)

    iv.   Non-volatility (1 Mark)

(c) Based on construction , list four types of basic registers used in digital electronics

(4 Marks)

Question Five (14 Marks)

(a) Simplify the Boolean function $F = AB + (AC)' + A B'C (AB + C)$. (4 Marks)

(b) Simplify the Boolean function $F = XYZ + XY'Z + XYZ'$. (3 Marks)

(c) What is a Half Adder, draw its logic diagram (4 Marks)

(d) Give a Truth table for the half adder (3 Marks)

Question Six (14 Marks)

(a) What is the function of a Karnaugh map. (2 Marks)

(b) State the various types of Karnaugh maps (3 Marks)

(c) What is a counter? (2 Marks)

(d) State the main categories of sequential circuits. (3 Marks)

(e) State two common features in both latch and flip flop. (2 Marks)

(f) Differentiate between Synchronous and asynchronous sequential logic circuits. (2 Marks)

Question Seven (14 Marks)

(a) Highlight any three Bipolar Transistor Configurations (3 Marks)

(b) Using well labeled diagram, explain the working mechanism of a MOSFET (11 Marks)