



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012
SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING
EEE 305: DIGITAL ELECTRONICS I

DATE: WEDNESDAY, 18TH APRIL 2012

TIME: 11.00 A.M. – 1.00 P.M.

INSTRUCTIONS

This paper consists of Five Questions

Question ONE is Compulsory. Answer Question one and any other two questions.

QUESTION ONE.

- (a). Discuss with the aid of a well labeled diagram the operation of mod-16 binary ripple counter using JK flip-flops. **[8 marks]**
- (b). Convert the following numbers without using a calculator
- (i). 14.55_{10} to binary equivalent. **[3 marks]**
- (ii). 731.32_{10} to hexadecimal equivalent. **[3 marks]**
- (iii). 1001001101_2 to octal equivalent. **[2 marks]**
- (c).
- (i). Simplify using Karnaugh map the following Boolean expression. **[4 marks]**
$$\overline{A}\overline{B}\overline{C}\overline{D} + \overline{A}\overline{B}C\overline{D} + \overline{A}B\overline{C}\overline{D} + \overline{A}BC\overline{D} + \overline{B}ACD + \overline{A}\overline{B}\overline{C}D = Y$$
- (ii). Prove your answer in (i) above using Boolean algebra. **[3 marks]**
- (iii). Draw the logic diagram of the simplified Boolean expression in (i) above. **[3 marks]**

(d).

- (i). Highlight the difference between a J-K flip-flop and a T flip-flop. **[2 marks]**
- (ii). Enumerate two main reasons why CMOS ICs are popular. **[2 marks]**

QUESTION TWO.

(a).

- (i). Subtract the following using 2's complement $23_{10} - 57_{10}$ without using a calculator **[6 marks]**
- (ii). Design a logic circuit to implement the following Boolean function using NOR gates only. $Y = \overline{A}B + C\overline{D} + E$ **[4 marks]**

(b). Explain the meaning of the following terms as used in digital electronics.

- (i). A combination logic circuit **[2 marks]**
- (ii). A Counter. **[2 marks]**
- (iii). A Truth Table **[2 marks]**
- (iv). A Flip-flop. **[2 marks]**
- (v). A register **[2 marks]**

QUESTION THREE

- (a). With the aid of a logic diagram, explain how a clocked R-S flip-flop operates. Show its truth table. **[8 marks]**
- (b). Explain with relevant circuit diagram the construction and operation of the standard CMOS two input NAND gate. **[8 marks]**
- (c). Perform the following arithmetic operation to 6 decimal places $101110_2 \div 1011_2$ without using a calculator. **[4 marks]**

QUESTION FOUR.

- (a). Highlight the applications of the following registers in a computer system. **[8 marks]**
 - (i). Memory Address Register
 - (ii). Instruction Register
 - (iii). Accumulator
 - (iv). Memory Data Register

- (b). Other than NOT logic gate, name and draw symbols for six other logic gates used in digital electronics. Write down their Boolean expressions using X and Y as inputs and Z as output. Draw their truth tables. **[9 marks]**
- (c). Perform the following arithmetic operation $13_8 \times 47_8$. Do not use a calculator. **[3 marks]**

QUESTION FIVE

- (a). Discuss the following three characteristics of Integrated Circuits (ICs) logic families.
- (i). Logic Levels. **[3 marks]**
 - (ii). Speed. **[3 marks]**
 - (iii). Power Dissipation. **[3 marks]**
- (b). Define what is a digital system and list six subsystems making it. **[8 marks]**
- (c). Explain what is a tri-state logic device and give an example of its application in a computer system. **[3 marks]**
