Mount Kenya University

UNIVERSITY EXAMINATION 2013/2014

SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF PHYSICAL SCIENCES

BACHELOR OF EDUCATION
SCHOOL BASED

UNIT CODE: BPS 324 UNIT TITLE: DIGITAL ELECRONICS AND DEVICES

DATE: APRIL/MAY 2014 MAIN EXAM TIME: 2 HOURS

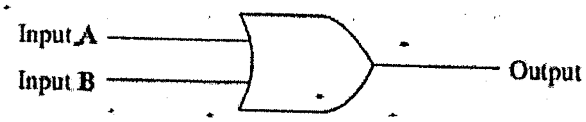
Answer Question one and any other Two

Question one

a) i) Briefly explain the term digitization. (1 mark)

ii) State **three** advantages and **one** limitation of digital technique when compared to analog technique. (4 marks)

b) The diagram shows the symbol for one type of logic gate.



i) Name the type of gate used. (1mark)

ii) Draw and complete the truth table of this gate. (3 marks)

c) Briefly explain the meaning of an encoder circuit. (2 marks)

d) Using symbols, list four types of flip flops (4 marks)

e) Convert the following to Binary

(i) 600_{10}

(ii) $(9F2)_{16}$

(4 marks each)

f) i) Define the term resolution as used in Analog to Digital voltage Converters (ADC) (2 marks)

ii) Calculate the ADC voltage resolution of a 8 bit ADC coding scheme when used to measure -5 to 5 Volts. (4 marks)

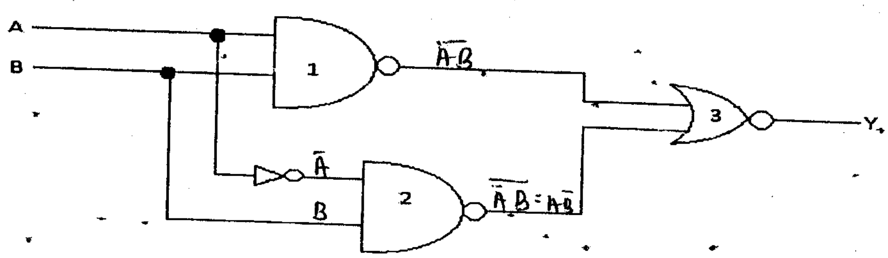
g) Using a block diagram, illustrate how a single bit full adder can be expanded to form a four bit full adder. (5 marks)

Question Two

a) What are universal gates? Name two universal gates. (3 marks)

b) Design a logic circuit having 3 inputs **A, B** and **C** which will have its output HIGH only when a majority of the inputs are HIGH. (10 marks)

c) Find the Boolean expression for the logic circuit shown in the figure below. (7 marks)



Figure

Question Three

a) i) Express the following equation as sum-of-product; (4 marks)

$F = A + BC + (A + \overline{C})B$

ii) Express the following equation as Product-of-Sum; (4 marks)

$F = AB + AC + B\overline{C}$

b) Write the equation $\mathbf{Q = \overline{A}B + \overline{C}B}$ in canonical form and leave your answer in the form $F = \sum(r_1, r_2, r_3)$ (6 marks)

A B C AB A B C AB

AC

BC

ABC

c) Prove De Morgan's Theorem for three variables $\overline{(A + B + C)} = \bar{A} + \bar{B} + \bar{C}$ by filling up a truth table. (6 marks)

Question Four

a) Solve the following using the binary system of numbers using 2's complements:

i) 72 – 45 =

ii) 45 – 20 = (6 marks)

b) Evaluate the following division using binary system of numbers: (6 marks)

i) 99 ÷ 11 =

ii) 324 ÷ 27 =

c) Convert the following Numbers without the use of calculator

(i) 1101_2 into decimals

(ii) 874_{10} into BCD

(iii) 01011110101101010010_2 into hexadecimal

(iv) 687_{10} into Hexadecimal

(2 marks each)

Question Five

a) i) How are a memory and a register related to a flip flop? (2 marks)

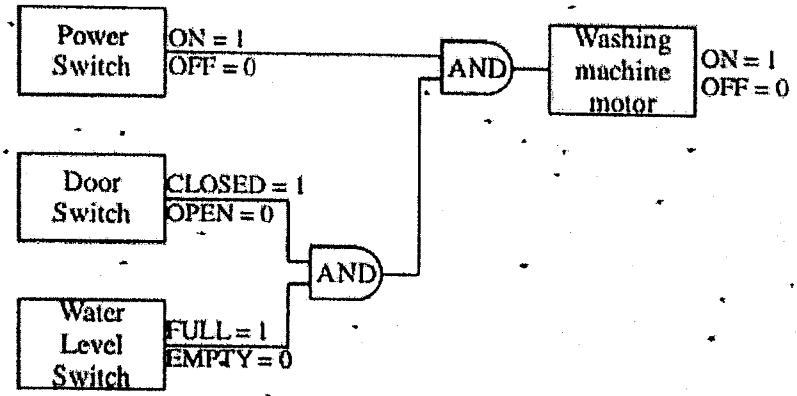
ii) Distinguish between a Static and a Dynamic memories. (4 marks)

iii) How many Flip flops do you require to store; (4 marks)

a) 8 byte data

b) 16kb data

b) The diagram shows a control system which may be fitted in an automatic washing machine.



i. Draw and complete a truth table for this control system.

(3 marks)

ii. What conditions will stop the washing machine working?

(3marks)

c) Simplify the expression (4 marks)

$$F(A,B,C) = \sum(0,3,4,7)$$

$(ABC) + (\bar{A}BC) + AB\bar{C}$

$\bar{A}BC + A\bar{B}C + AB\bar{C} + ABC = AB + BC + AC$

$\cancel{\bar{A}BC}$ $\cancel{AB\bar{C}}+$

$\bar{A}BC + ABC + A\bar{B}C + ABC + AB\bar{C} + ABC$

$BC(\bar{A} + A) + AC(\bar{B} + B) + AB(\bar{C} + C)$