



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (TELECOMMUNICATION AND INFORMATION
TECHNOLOGY)

SPH 207: DIGITAL ELECTRONICS AND DEVICES

DATE: 3/5/2019

TIME: 8.30-10.30 AM

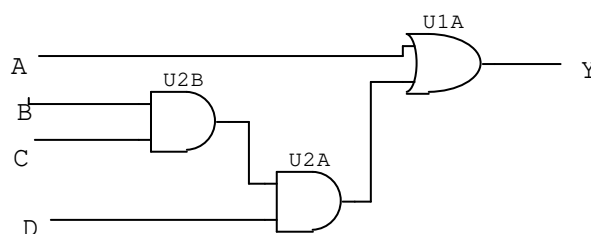
INSTRUCTIONS

Answer Question ONE and any other TWO Questions.

QUESTION ONE (30 MARKS)

- a) Find the boolean expression for the out put of fig below and compute the output value when

$A=0, B=1, C=0$ and $D=1$



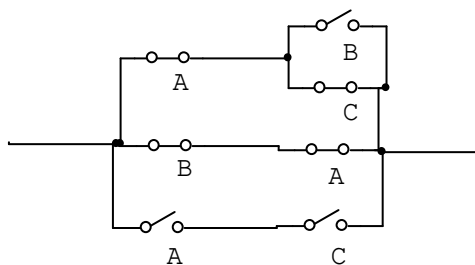
(5 marks)

- b) i Differentiate between decimal number system and hexadecimal number system hence convert $A031_{16}$ to its decimal equivalent. (5 marks)
- ii. Using 2's complement subtract 1010_2 from 1101_2 (2 marks)
- iii. Design a circuit to convert 3 bit binary numbers into grey code. (6 marks)
- iv. describe any three characteristics of logic families. (6 marks)

- v. by use of S-R flip flop, draw a diagram that would be applied in a design of a burglar alarm consisting of a series switches connected to doors and windows throughout a building such that opening any door or window opens the corresponding switch which should sound the alarm (6 marks)

QUESTION TWO (20 MARKS)

- a) Derive a logic expression from the relay switching circuit of the figure below and minimize it as far as possible hence draw the equivalent simplified logic diagram.



(6 marks)

- b) Define the following terms used in CMOS devices
- Propagation delay
 - Set up time
 - Hold time
- (3 marks)
- c) Sketch the transfer characteristic of a TTL gate. (4 marks)
- d) Explain the difference between a 7400 and 5400 devices (3 marks)
- e) Describe the operation and function of a schmitt trigger. (4 marks)

QUESTION THREE (20 MARKS)

- a) From the truth table below, derive
- logic expression for f
 - simplify the expression as far as possible

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

- iii. draw the logic diagram to implement this (8 marks)
- b) a digital system is to be designed with two inputs and three outputs. the system should function under the following conditions
- output x indicates the absence of both inputs
 - output y indicates the presence of either input and absence of the other.
 - Output z indicates the presence of both inputs. Using logic equations and truth table:
- Draw the logic diagram for the system using the minimum number of gates
 - Modify your logic diagram to its simplest form using NAND gates only.
- (12 marks)

QUESTION FOUR (20 MARKS)

- Define the terms bistable, monostable and astable multivibrators (3 marks)
- Design a modulo-5 asynchronous counter using a J-K negative going edge triggered flip flops (5 marks)
- Explain the advantages and disadvantages of CMOS logic compared to NMOS (6 marks)
- In an S-R bistable formed using two NOR gates, are the inputs active high or low? Draw the transition table and a Karnaugh map of such a circuit. (6 marks)
- Explain two differences between digital to analogue and analogue to digital converters. (6 marks)

QUESTION FIVE (20 MARKS)

- a) Identify two main components of a typical data acquisition system. (2 marks)
- b) Explain the use of sample and hold gates in analogue input /output systems. What is meant by the term 'droop' when applied to such gates. (3 marks)
- c) A signal has a frequency spectrum which extends as high as 2kHz. What is the minimum rate at which this signal may be sampled to obtain a good representation of its form. What would be the effect of sampling below this rate. (3 marks)
- d) Show how a power source, a lamp and a number of switches can be used to represent the following logical functions.
- i. $L = A.B.C$
 - ii. $L = A + B + C$
 - iii. $L = (A.B) + (C.D)$
 - iv. $L = A + B$ (12 marks)