UNIVERSITY EXAMINATIONS

EXAMINATION FOR JANUARY/APRIL 2015/2016 FOR BACHELOR OF SCIENCE IN COMPUTER SCIENCE

RCCS 101: - DIGITAL LOGIC.

DATE: 13th/April /2016. TIME: 2 HOURS

GENERAL INSTRUCTIONS:

Students are NOT permitted to write on the examination paper during reading time.

This is a closed book examination. Text book/Reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:

This examination paper consists Questions in Section A followed by section B.

Answer **Question 1 and any Other Two** questions.

QUESTIONS in ALL Sections should be answered in answer booklet(s).

1. **PLEASE start the answer to EACH question on a NEW PAGE. You will lose 5 MARKS if this is not done.**
2. **Keep your phone(s) switched off at the front of the examination room and NOT on your person.**
3. **Keep ALL bags and caps at the front of the examination room and DO NOT refer to ANY unauthorized material before or during the course of the examination.**
4. **ALWAYS show your working.**
5. **Marks indicated in parenthesis i.e. ( ) will be awarded for clear and logical answers.**
6. **Write your REGISTRATION No. clearly on the answer booklet(s).**
7. **For the Questions, write the number of the question on the answer booklet(s) in the order you answered them.**
8. **Calculator will be required.**

SECTION A (COMPULSORY)

Question (1) - (30Marks)

a) Differentiate between Analog and Digital Signals. **(2 Marks)**

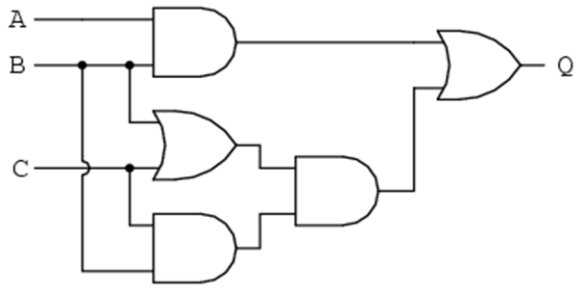
b) With respect to digital electronics circuits signals, define the following terms. **(5Marks)**

i. Rise time.
ii. Fall time.
iii. Propagation time.
iv. Fan out.
v. Fan in.

c) Implement the Boolean expression below using suitable logic gates.

Y_{out} = [(AB) C+ (CDE) (BCE)]. **(5 Marks)**

d) Considering the digital circuit below, derive the Boolean function (Q) that is an equivalent expression of the circuit. **(5 Marks)**



e) Workout the following calculations. (Show the working) **(6 Marks)**

i. $11111111_2 + 456_8$ Results in decimal number.
ii. $BACB_{16}+111001100011_2$ Results in decimal number.
iii. 1357_8+9BDF_{16} Results in Hexadecimal number.

f) Describe the functions of the ADC and DAC in the digital and computer system. Hence give two types of ADC circuitry. **(4 Marks)**

g) Define the De-Morgan's theorem, and show both variations of it. **(3 Marks)**

SECTION B (Answer Any Two Questions)

Question (2) - (20Marks)

a) Express the following numbers in the specified Format. **(4 Marks)**

i. 10101001_{binary} - into Gray Code.

ii. 11010101_{gray} - into Binary.

iii. 111001011001_2 - Octal number.

iv. 111101010101_2 - Two's complements.

b) Perform the following calculations. **(8 Marks)**

i. $1111_2 - 7_{10}$ - Using twos complements.

ii. $AFDE_{16} + 79CDF_{16}$ -Express the results in Hexadecimal.

iii. $10111011_2 + 10110111_2$ - Express the results in Decimal.

iv. $1010_2 \times 1111_2$ - Express the results in Decimal.

c) Name two universal gates used in the digital circuitry fabrication. **(2 Marks)**

d) Using any universal gate of your choice, implement the following basic logic gates.

i. NOT Gate. **(1 Marks)**

ii. AND Gate. **(2 Marks)**

iii. OR Gate. **(3 Marks)**

Question (3) - (20Marks)

a) State uses of the Gray code in digital electronics/communication. **(2 Marks)**

b) Design a four bit Binary to gray code converter circuit. NB you can use the K-Mapping method or the Boolean simplification method. Hence implement the logic circuit. **(12 Marks)**

c) Describe the functionalities of the following digital circuits. **(6Marks)**

i. Flip flop.
ii. Counters.
iii. Multiplexers.
iv. De-multiplexers.
v. Memory cell.
vi. Encoders

Question (4) - (20Marks)

a) Using ***Karnaugh Mapping*** technique of Boolean simplification, simplify the Boolean function below to the simplest term. **(8 Marks)**

$$Y_{Out} = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}CD + \bar{A}\bar{B}C\bar{D} + A\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}D + A\bar{B}CD + A\bar{B}C\bar{D}$$

b) Draw the basic logic gates, used in Digital electronics. Hence show their truth tables as well as the Boolean expressions. **(7 Marks)**

c) Convert the following numbers, into the indicate number systems. **(5Marks)**

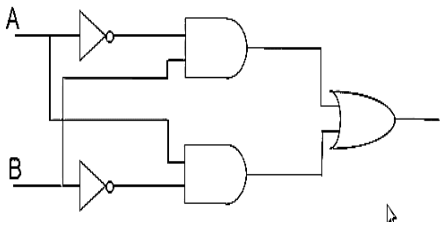
i.	135_{10}	into binary number.
ii.	2460_{8}	into decimal number.
iii.	11000011_{2}	into decimal number.
iv.	$DAABC00_{16}$	into octal number.
v.	10101111110101100010_{2}	into Hexadecimal number.

Question (5) - (20Marks)

a) Differentiate between a full adder and half adder. **(4 Marks)**
(Use suitable block diagram)

b) Design a full adder circuit, and implement the circuit using suitable gates. **(8 Marks)**

c) Simplify the following digital circuit to the simplest circuit. **(3 Marks)**



d) Select the collect choice, in the following multiple choice questions. **(5 Marks)**

i. How many JK - Flip-Flops are required for mod–64 counter?
   (A) 5.
   (B) 6.
   (C) 8.
   (D) 4.

ii. What is the binary equivalent of the decimal number 368?

(A) 101110000.
(B) 110110000.
(C) 111010000.
(D) 111100000.

iii. In which of the following gates, the output is 1, if at least one input is 1

(A) NOR.
(B) AND.
(C) OR.
(D) NAND.

iv. The time required for a gate to change state is referred to as

(A) Fall time.
(B) Decay time.
(C) Propagation time.
(D) Rise time.

v. Which of the following gates can be used in detecting Parity bits in error correction

(A) OR gate.
(B) AND gate.
(C) NOR gate.
(D) XOR gate.