

**CEL&ETL - Analog and Digital
Systems**

T013

Monday, 26/11/2018

08:30 - 11:30 AM

WORKFORCE DEVELOPMENT AUTHORITY



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**ADVANCED LEVEL NATIONAL EXAMINATIONS, 2018,
TECHNICAL AND PROFESSIONAL STUDIES**

EXAM TITLE: ANALOG AND DIGITAL SYSTEMS

OPTIONS: Computer Electronics (CEL)

Electronics and Telecommunication (ETL)

DURATION: 3 hours

INSTRUCTIONS:

The paper is composed of **three (3) main Sections** as follows:

Section I: Fifteen (15) compulsory questions. 55 marks

Section II: Attempt any three (3) out of five questions. 30 marks

Section III: Attempt any one (1) out of three questions. 15 marks

Note:

Every candidate is required to carefully comply with the above instructions. Penalty measures will be applied on their strict consideration.

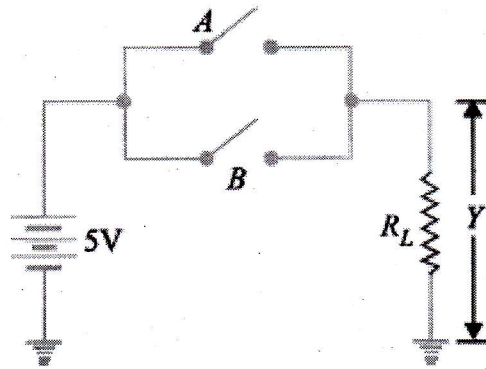
01. Convert the binary number 110001 to its equivalent decimal number.

(3 marks)

02. Convert $(B2F)_{16}$ to octal.

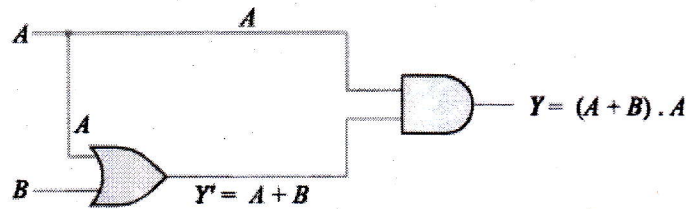
(3 marks)

03. Interpret the following circuit using a truth table.



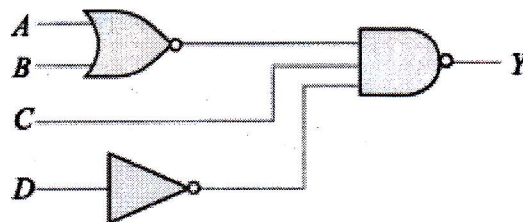
(3 marks)

04. Obtain the truth table from the circuit shown in figure below.



(3 marks)

05. Determine the output expression for the circuit shown below and simplify it using De Morgan's theorem.



(5 marks)

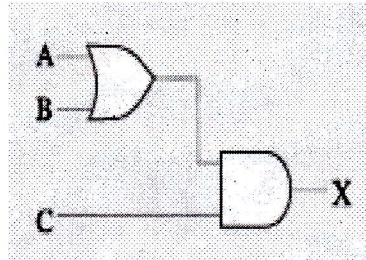
06. Given the two binary numbers $X = 1010100$ and $Y = 1000011$, perform the subtraction of $X - Y$ by using 2's complement.

(4 marks)

07. Convert 25.62510 into its binary equivalent.

(4 marks)

08. Find the Boolean expression for the output of figure below and evaluate it when $A = 0$, $B = 1$, $C = 1$.

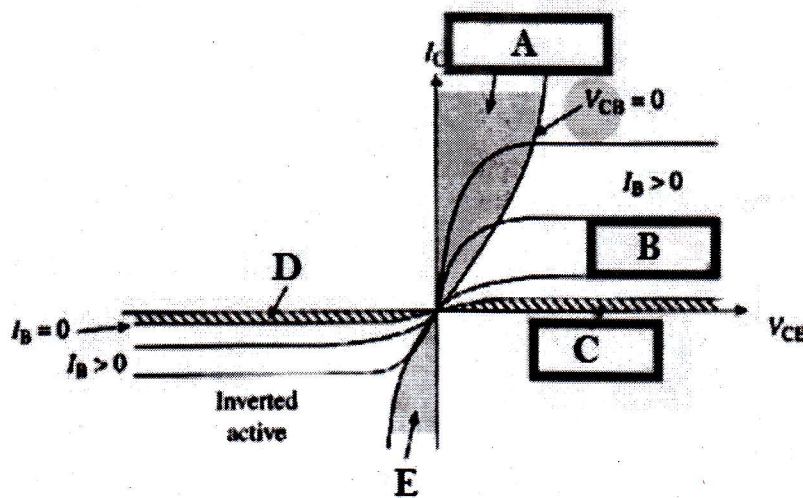


(4 marks)

09. List out the two types of BJT.

(2 marks)

10. From the figure below, fill the proper terms to replace (label) A, B, C, D and E.

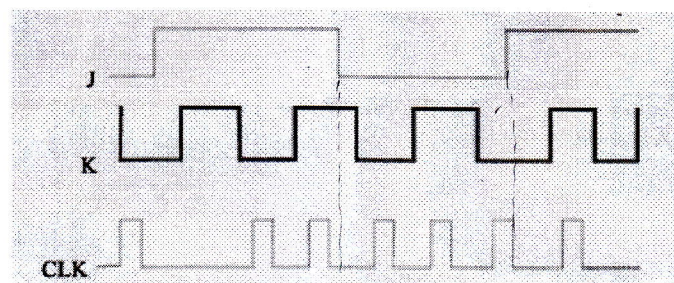


(5 marks)

11. Classify FETs according to the type of the channel.

(6 marks)

12. What will be the output waveform Q of a J-K flip-flop if the following waveforms are applied at the input? Assume the flip-flop triggers at the falling edge of clock pulse.



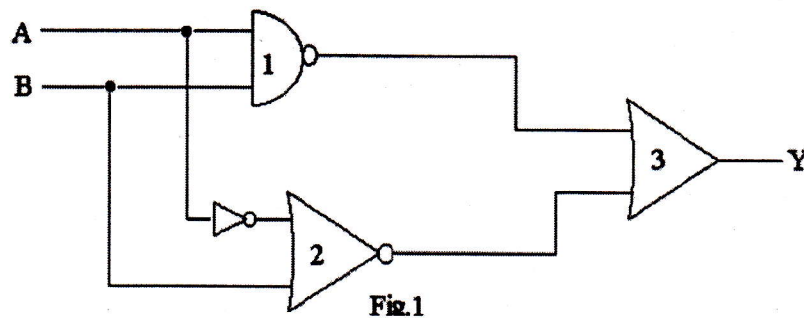
(4 marks)

13. A silicon diode dissipates 3W for a forward dc current of 2A. Calculate the forward voltage drop across the diode and its bulk resistance. (3 marks)
14. Explain the terms:
 (a) Peak Inverse Voltage; (b) Bulk resistance (3 marks)
15. Differentiate asynchronous from synchronous counters. (3 marks)

Section II. Choose and answer any three (3) questions

30 marks

16. a) Find the Boolean expression for logic circuit shown the following figure and reduce it using Boolean algebra.



- b) Implement the following function using 4-to-1 multiplexer.

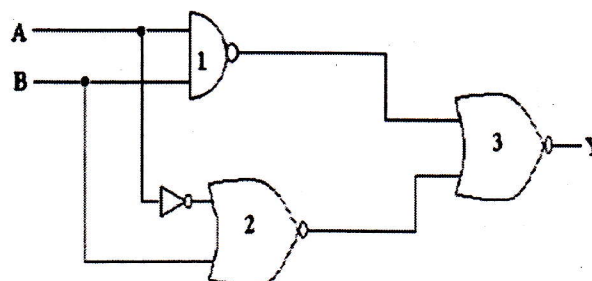
$$Y(A, B, C) = \sum (2, 3, 5, 6)$$

(10 marks)

17. a) Reduce the following equation using k-map

$$Y = B\bar{C}\bar{D} + \bar{A}B\bar{C}D + A\bar{B}\bar{C}D + \bar{A}BCD + ABCD$$

- b) Find the Boolean expression for the logic circuit shown below:



(10 marks)

18. A staircase light is controlled by two switches one at the top of the stairs and another at the bottom of stairs:

- a) Make a truth table for this system;
- b) Write the logic equation in SOP form;
- c) Realize the circuit using AND-OR gates.

(10 marks)

19. a) What is a flip-flop?

b) What is the difference between a latch and a flip-flop?

c) List out the application of flip-flop.

(10 marks)

20. Using a block diagram, make a distinction between combinational logic circuits and sequential logic circuits.

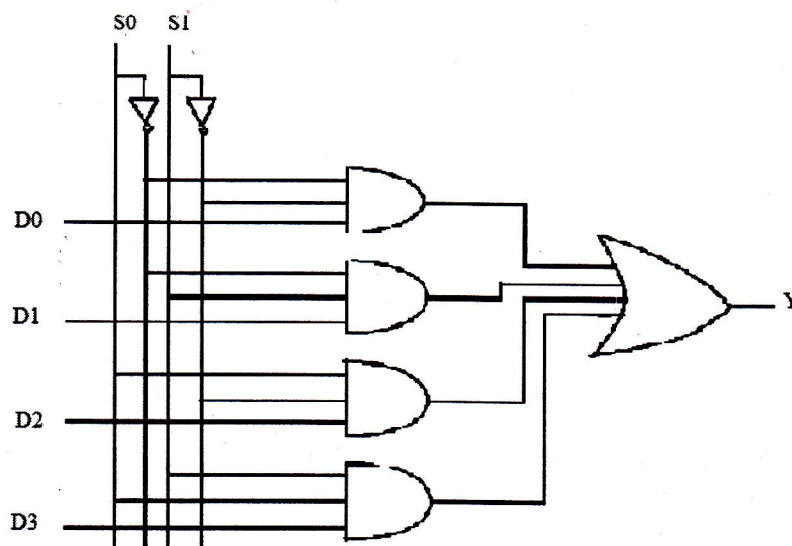
(10 marks)

Section III. Choose and answer any one (1) question

15 marks

21. a) Explain how a multiplexer works (4lines max.)

b) Consider the diagram below of a 4 - to - 2 Multiplexer.



Name the pins labeled S0, S1 , Do, D1,D2,D3 and Y.

c) Complete the corresponding table given below (reference to the diagram in b)

So	S1	Y
0	0	
0	1	
1	0	
1	1	

(15 marks)

22. Simplify the following expression and draw the circuit that perform the obtained function:

$$Y = A\bar{B}\bar{C} + A\bar{B}C + A\bar{B}\bar{C} + A\bar{B}C + A\bar{B}\bar{C} + A\bar{B}C$$

(15 marks)

23. Use the Karnaugh mapping procedure to simplify the following Sum - Of - Products:

$$X = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D} + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D$$

(15 marks)