CEL \& ETL - Analog and Digital Systems

T005
Friday, 31/10/2014
01:30-04:30 PM


# ADVANCED LEVEL NATIONAL EXAMINATIONS, 2014 TECHNICAL AND PROFESSIONAL TRADES 

EXAM TITLE: Analog and Digital Systems

## OPTIONS: - Computer Electronics (CEL)

- Electronics and Telecommunication (ETL)

DURATION: 3hours

## INSTRUCTIONS:

The paper consists of three (3) Sections :

Section I: Fourteen (14) questions, all Compulsory.
55marks

Section II: Five (5) questions, Choose any Three (3).
30marks
Section III: Three (3) questions, Choose any One (1).
15marks

## SECTION I. FOURTEEN (14) COMPULSORY QUESTIONS.

1. Find the canonical form of the following Boolean expression :

$$
\mathrm{F}(\mathrm{~A}, \mathrm{~B}, \mathrm{C})=\mathrm{AB}+\mathrm{BC} .
$$

## 3marks

2. Design a D flip-flop from a J-K flip-flop.
3. What should be done to unused inputs on TTL gates?
4. Which functions a GTO gate drive circuit has to fulfill?
5. Identify two (2) different methods to represent basic logic functions.
6. Explain the functioning of the following circuit by turning ON and switch off quickly that circuit :

a) Without diode;
b) With diode mounted.

4marks
07. Identify the component of a typical transducer measurement system bloc (output digital).
08. Identify the components of the 555 timer.
09. Identify any five (5) methods of thyristor turn on.
10. Specify two (2) different methods of voltage control inverters.
11. Describe the function of freewheeling diode in a controlled rectifier circuit.3marks
12. Identify any five (5) characteristics of an amplifier that are modified by negative feedback.
13. Simplify the following expression using Boolean algebra technique
$Z=A B+A(B+C)+B(B+C)$.
5marks
14. Identify five (5) applications of $A C$ voltage controllers.

## SECTION II. ATTEMPT ANY THREE (3) QUESTIONS.

15. a) Find the period (in msec ) of the output pulse in the circuit shown below and give a name at this circuit.

b) Show how a full adder may be implemented by using two half adders.

5marks
16. Describe the basic operation of a single-slope analog to digital converter.
17. Identify the logic families according to the technology they are built with and specify which family is widely used.
18. In the following circuit, the specifications of zener diode at $25^{\circ} \mathrm{C}$ are: ( $\mathbf{1}^{\circ}$ ) bias current: 10 mA ; $\left(\mathbf{2}^{\circ}\right)$ output voltage: 2495 mV
The diode is forward biased at 2 mA with forward voltage drop of 0.55 V ;


Determine $R_{B 1}$ and $R_{B 2}$ and select both values of resistors from the list of $1 \%$ decade values.

10marks
19. a) For the circuit below, determine the function performed; the role of $\mathrm{S} 1, \mathrm{Rb}, \mathrm{Cb}$ and S 2 .
b) Determine different modes of operation of that circuit.


## SECTION III. ATTEMPT ANY ONE (1) QUESTION.

20. Consider the circuit below and answer to the following questions:
a) Determine the type of circuit and its characteristics
b) What is the function of VD1, VD2, VD3 and VD4
c) Explain briefly the operation of the circuit.

15marks

21. For the following circuit,
a) Identify the main functional parts.
b) Study the behavior.

15marks

22. Consider the statement: " $Z$ is TRUE if at least two of $W, X$ and $Y$ are TRUE", otherwise $Z$ is FALSE".
a) Write a Boolean expression for the above statement.
b) Write a truth table for the function $Z$;
c) Implements $Z$ using only NOR gates.

