CEL & ETL – Analog and

Digital Systems

T005

Friday, 31/10/2014 01:30 - 04:30 PM WORKFORCE DEVELOPMENT AUTHORITY



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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.55marksSection II: Five (5) questions, Choose any Three (3).30marksSection III: Three (3) questions, Choose any One (1).15marks

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SECTION I. FOURTEEN (14) COMPULSORY QUESTIONS.

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

	F(A,B,C) = AB + BC.	3marks
02.	Design a D flip-flop from a J-K flip-flop.	2marks
03.	What should be done to unused inputs on TTL gates?	5marks
04.	Which functions a GTO gate drive circuit has to fulfill?	4marks
05.	Identify two (2) different methods to represent basic logic functions.	2marks

06. 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).	5marks
08.	Identify the components of the 555 timer.	5marks
09.	Identify any five (5) methods of thyristor turn on.	5marks
10.	Specify two (2) different methods of voltage control inverters.	2marks
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.	5marks
13.	Simplify the following expression using Boolean algebra technique	
	Z = AB + A (B + C) + B (B + C).	5marks
14.	Identify five (5) applications of AC voltage controllers.	5marks

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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.5marks



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.10marks
- 18. In the following circuit, the specifications of zener diode at 25°C are: (1°) bias current: 10mA; (2°) output voltage: 2495mV
 The diode is forward biased at 2mA with forward voltage drop of 0.55V;



Determine R_{B1} and R_{B2} 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 S1, Rb, Cb and S2.
 - b) Determine different modes of operation of that circuit.

10marks



10marks

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.



a) Identify the main functional parts.

Vcc

Disch

555

RST

Out

b) Study the behavior.

 $10 k\Omega$

10

- **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.





kΩ Thresh Ø σ Ctr1 6 V Trig R R Gnd 0.1 µF 💈 (MSB) (LSB) 1 470Ω •470Ω 470Ω

S

Q

S

Q

15marks

15marks