

CEL&ETL – General Electronics

**T091**

Monday, 14/11/2016

08:30 – 11:30

WORKFORCE DEVELOPMENT AUTHORITY



P.O. BOX 2707 Kigali, Rwanda Tel: (+250) 255113365

---

**ADVANCED LEVEL NATIONAL EXAMINATIONS, 2016,  
TECHNICAL AND PROFESSIONAL STUDIES**

**EXAM TITLE: General Electronics**

**OPTIONS: Computer Electronics (CEL)**

**Electronics and Telecommunication (ETL)**

**DURATION: 3hours**

**INSTRUCTIONS:**

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

**Section I: Fourteen (14) 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**

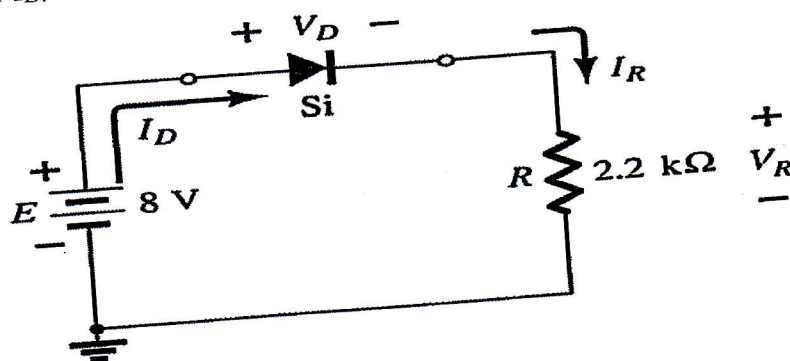
**Note:**

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

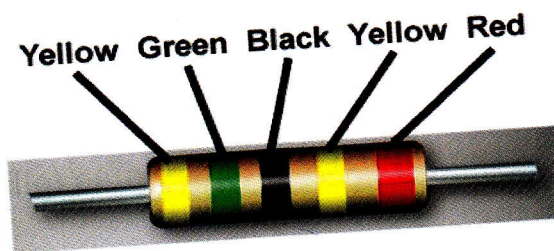
**Section I. Fourteen (14) Compulsory questions.**

**55marks**

01. What do you mean by covalent bonding? **2marks**
02. Give the difference between intrinsic material and extrinsic materials. **4marks**
03. What is the difference between semiconductor diode switch and mechanical switch in terms of current flow? **4marks**
04. What are the specific data that must be given on specification sheet (or nameplate) of semiconductor device? **4marks**
05. Who can diode condition be tested? **3marks**
06. The circuit below shows the series diode configuration in ON state. Compute the  $V_D$ ,  $V_R$  and  $I_D$ . **5marks**



07. Use the color code chart to calculate the value and tolerance of this 5-band resistor. **5marks**



08. What are the **three** types of power used in an a.c circuit? **3marks**
09. Why voltmeter and ampere meter (or current meter) during electrical measurement are connected in parallel and in series respectively? **6marks**
10. Find the conductance of a conductor of resistance; **3marks**
- (a) 10  $\Omega$ ,
- (b) 5 k  $\Omega$  and
- (c) 100 m  $\Omega$

11. Simplify the following expression using Boolean algebra technique

$$Z = AB + A(B + C) + B(B + C)$$

6marks

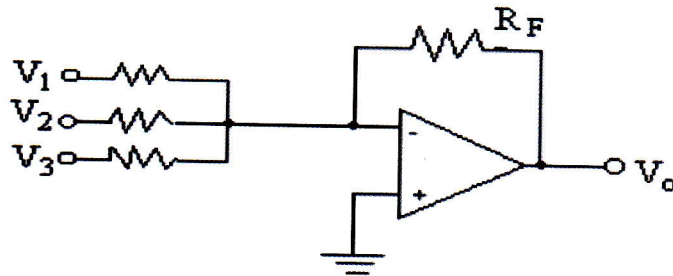
12. Compute the frequency of oscillation of a tunnel-collector oscillator which has

$$L = 30\mu\text{H} \quad \text{and} \quad C = 300\text{pf}$$

3marks

13. Calculate the output voltage in the circuit shown below whereby:  $R_1 = 12\text{K}\Omega$ ,  $R_2 = 5\text{K}\Omega$ ,  $R_3 = 8\text{K}\Omega$ ,  $R_F = 12\text{K}\Omega$  and the inputs are:  $V_1 = 9\text{V}$ ,  $V_2 = -3\text{V}$  and  $V_3 = -1\text{V}$ .

3marks

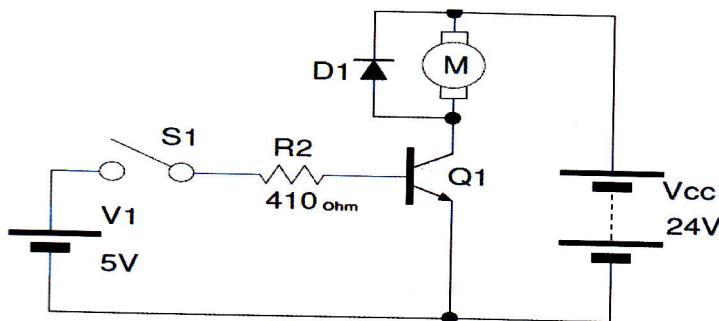


14. The figure below shows a bipolar junction transistor (BJT) used to switch a small motor on and off in response to switch  $S_1$  closing and opening. The BJT is specified with  $\beta_{DC} = 100$  and  $BV_{CEO} = 40\text{ V}$ . The motor draws 1 Amp from a 24 volt supply when running.

4marks

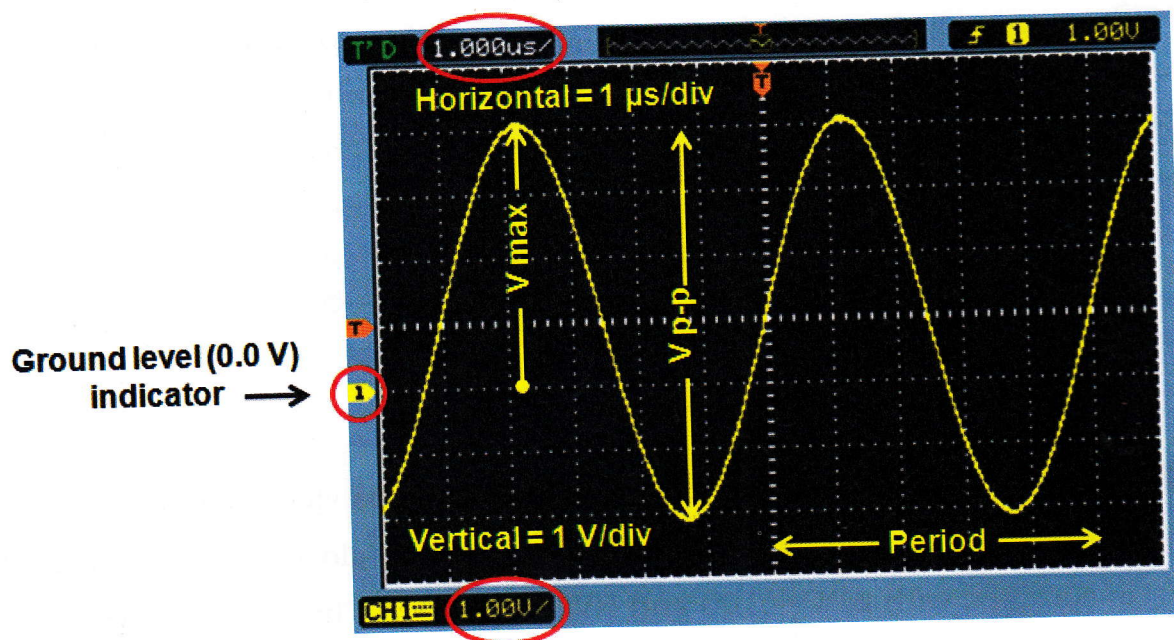
Calculate the base current in the BJT when:

- $S_1$  is closed.
- $S_1$  is Open



15. A. From the given waveforms of figure below. Determine:

- a)  $V_{max}$ ,      b)  $V_{p-p}$ ,      c) Period and      d) Frequency



B. The given Boolean expression is:

$Y = A\bar{B} + B\bar{A}$  If  $A = 1$  and  $B = 1$ , then  $Y =$  (i) 1 (ii) 0 (iii) either 1 or 0.

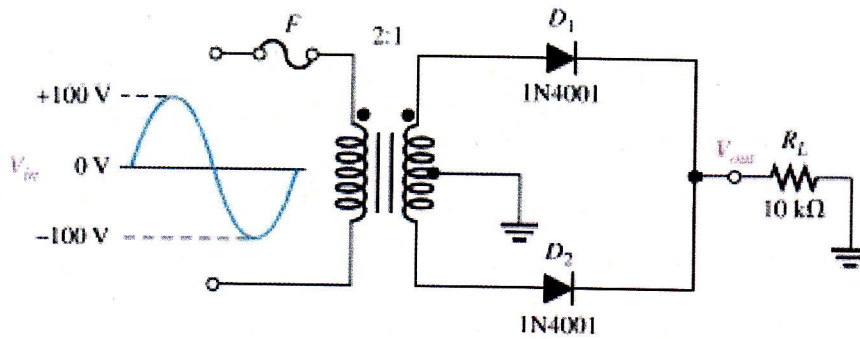
10marks

16. Find solution to the following questions:

- The deflection sensitivity of a CRT is 0.03 mm/V. If an unknown voltage is applied to the horizontal plates, the spot shifts 3 mm horizontally. Find the value of unknown voltage?
- The deflection sensitivity of a CRT is 0.01 mm/V. Find the shift produced in the spot when 400 V are applied to the vertical plates?
- Give three important applications of CRO?

10marks

17. A) Using the following circuit;

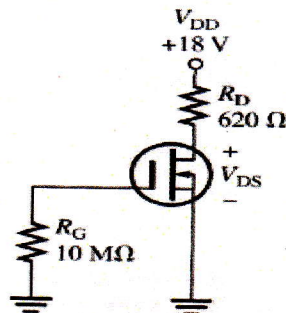


- Show the voltage waveform across each half of the secondary winding and across  $R_L$  when a 100V peak sine wave is applied to the primary winding?
- What minimum PIV rating must the diodes have?

B) A differential amplifier has an open-loop voltage gain of 120. The input signals are 2.45 V and 2.35 V. Calculate the output voltage of the amplifier?

**10marks**

18. A. Determine the drain-to-source voltage in the circuit shown in the following figure. The MOSFET data sheet gives  $V_{GS(off)} = -8V$  and  $I_{DSS} = 12mA$ .



B. Three capacitors A, B, C have capacitances 10, 50 and  $25\mu F$  respectively as shown in figures (a) and (b). Calculate:

- Charge on each when connected in parallel to a 250 V supply.
- total capacitance and
- P.d. across each when connected in series.

**10marks**

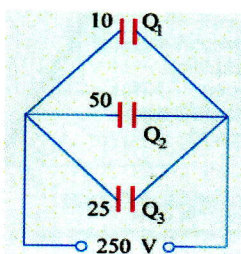


Figure (a)

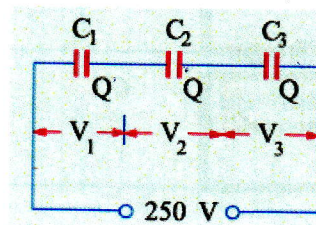
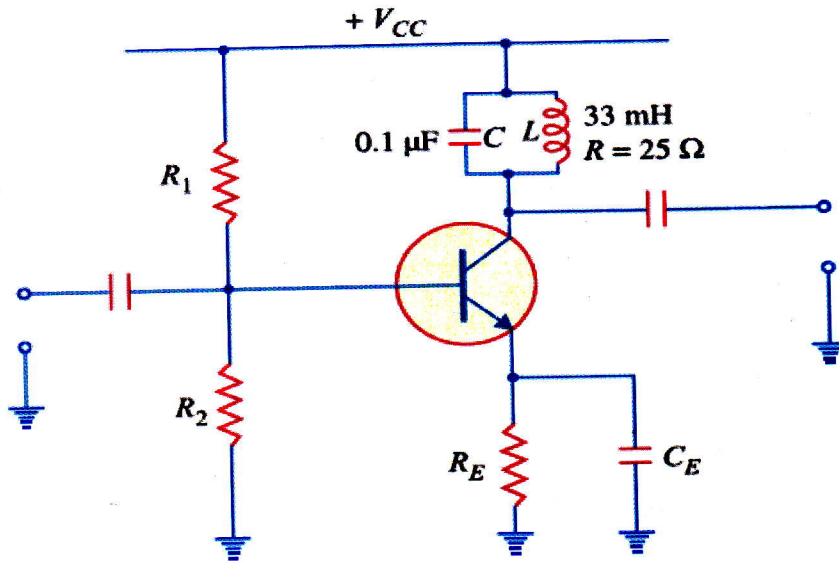


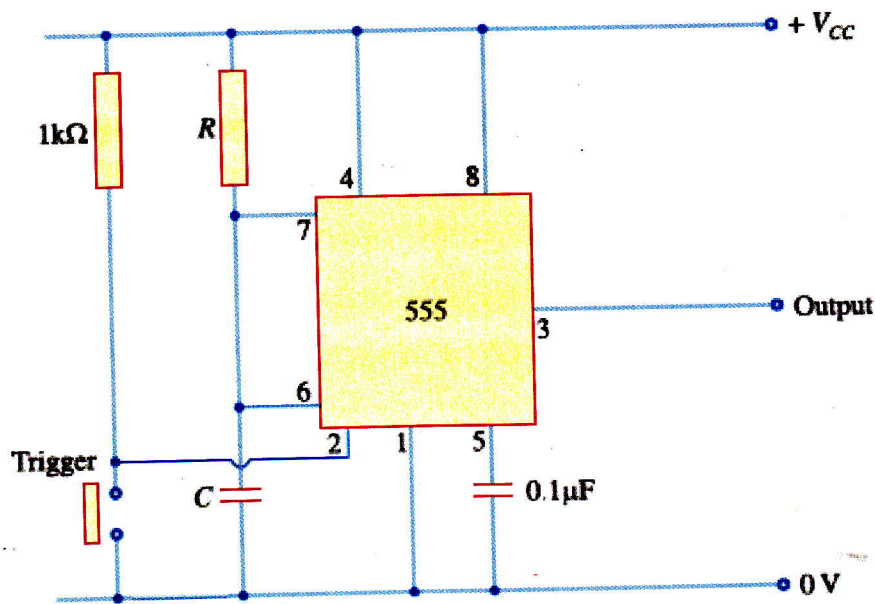
Figure (b)

19. A. For the tuned amplifier shown in figure below, determine:

- i) the resonant frequency
- ii) the Q of tank circuit and
- iii) bandwidth of the amplifier.

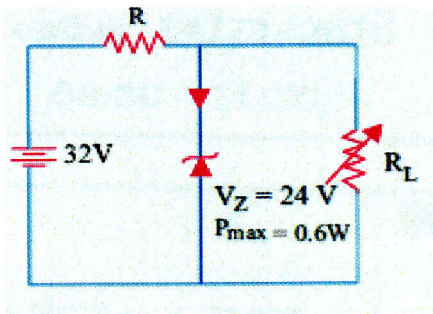


B. The monostable multivibrator like the one in Figure 13 has the values of  $R = 1.2 \text{ k}\Omega$  and  $C = 0.1 \mu\text{F}$ . Determine the time  $T$  for which the circuit is on.



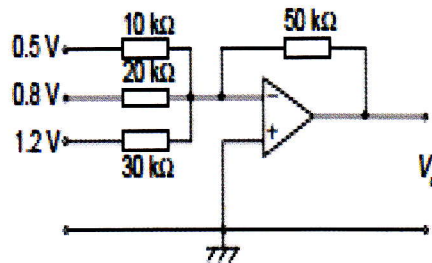
C. A 24-V, 600-mW Zener diode is to be used for providing a 24V stabilized supply to a variable load figure below. If input voltage is 32 V, calculate:

- i) Series resistance R required
- ii) Diode current when  $R_L = 1200 \Omega$ .



15marks

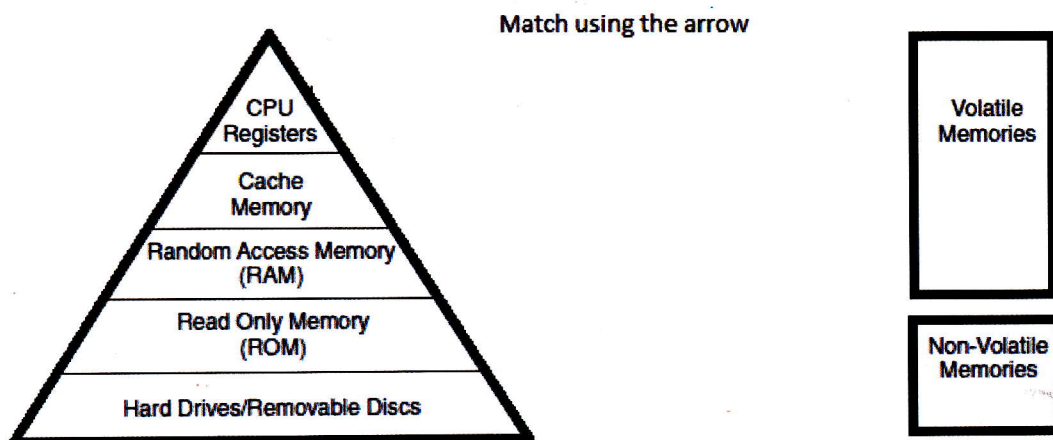
20. A. For the summing op amp shown in Figure below, determine the output voltage,  $V_o$



B. A differential amplifier has an open-loop voltage gain of 120 and a common input signal of 3.0 V to both terminals. An output signal of 24 mV results. Calculate the common-mode gain and the CMRR.

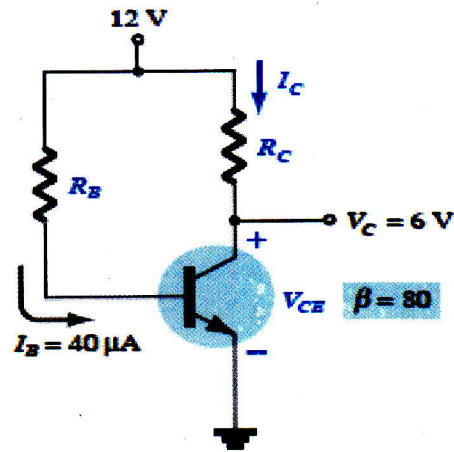
C. A resistor with the color code **brown, red, yellow** is connected to a 30V source. What is  $I$ ?

D. Match the first column to the second one using arrow.



15marks

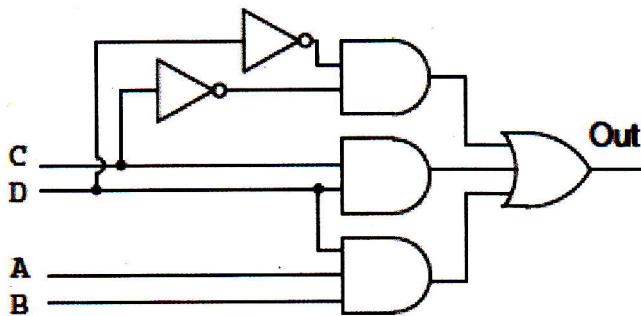
21. A. Given the information appearing in figure below, determine: (a)  $I_C$ , (b)  $R_C$ , (c)  $R_B$ , (d)  $V_{CE}$



- B. Using Karnaugh map, simplify the following expression:

$$F = \bar{A}\bar{B}CD + \bar{A}BCD + ABCD + A\bar{B}CD + AB\bar{C}\bar{D} + AB\bar{C}D + ABC\bar{D}$$

- C. From the logic circuit diagram shown below, find out the corresponding logic expression (out)



15marks