

**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL (TVET CDACC)**

**Qualification Code :** 061006T4ICT

**Qualification :** ICT Technician Level 6

**Unit Code :** IT/OS/ICT/CC/01

**Unit of competency :** Apply Basic Electronics

**ASSESSOR’S GUIDE**

**SECTION A (40 MARKS)**

***(These are suggested answers to act as guidelines.)***

1. Define Cache Memory (2 Marks)

Cache memory is a very high speed semiconductor memory which can speed up CPU. It acts as a buffer between the CPU and main memory. It is used to hold those parts of data and program which are most frequently used by CPU. The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.

1. Highlight any TWO advantages and TWO disadvantages of cache memory (4 Marks)

**Advantages**

* Cache memory is faster than main memory.
* It consumes less access time as compared to main memory.

**Disadvantages**

* Cache memory has limited capacity.
* It is very expensive.

1. Outline any SIX Characteristics of Auxiliary Memory (6 Marks)

* **Non-volatile memory** − Data is not lost when power is cut off.
* **Reusable** − The data stays in the secondary storage on permanent basis until it is not overwritten or deleted by the user.
* **Reliable** − Data in secondary storage is safe because of high physical stability of secondary storage device.
* **Convenience** − With the help of a computer software, authorised people can locate and access the data quickly.
* **Capacity** − Secondary storage can store large volumes of data in sets of multiple disks.
* **Cost** − It is much lesser expensive to store data on a tape or disk than primary memory.

1. Explain the TWO types of RAM (4 Marks)

* **Dynamic RAM.**[DRAM](https://searchstorage.techtarget.com/definition/DRAM) is a type of semiconductor memory that is typically used by the data or program code needed by a computer processor to function.
* **Static RAM.**[SRAM](https://whatis.techtarget.com/definition/SRAM-static-random-access-memory) retains data bits in its memory for as long as power is supplied to it. Unlike DRAM, which stores bits in cells consisting of a capacitor and a transistor, SRAM does not have to be periodically refreshed.

1. Define electric current? (2 marks)

The flow of electrons through an [electrical circuit](https://www.thegreatcoursesdaily.com/wp-admin/post.php?post=131491&action=edit) is called the electrical current and is measured in amperes.

1. Highlight FOUR advantages of using Integrated Circuits (4 Marks)

* Very small size: Hundred times smaller than the discrete circuits.
* Lesser weight: As large number of components can be packed into a single chip, weight is reduced
* Reduced cost: The mass production technique has helped to reduce the price,
* High reliability: Due to absence of soldered connection, few interconnections and small temperature rise failure rate is low.
* Low power requirement: As the size is small power consumption is less.
* Easy replacement: In case of failure chip can easily be replaced. Computer cannot function without an operating system.

1. Differentiate between the following (4 Marks)
2. A.C and D.C currents
   * ***DC current*** - The current does not vary with time is called direct current. It is denoted by I.
   * ***AC current*** - The current varies with time is called alternating current. It is denoted by i (or)i(t).

ii. Electrolyte and Electrode

* + ***An electrolyte*** - is basically a medium for the current flow. Electrolytes consist of a strong and weak electrolyte
  + ***An electrode*** - is a connection between the conducting part of the circuit and the non-metallic part of the circuit. Electrodes consist of anode and cathode.

1. What is the meaning of doping in electronics? (2 Marks)

Doping is a technique used to vary the number of electrons and holes in semiconductors

1. Explain the following as used in electronics. (6 Marks)

* ***Hole current*** - The movement of the hole (positively charged vacancy in the valence band) from positive terminal of the supply to negative terminal through semiconductor constitutes hole current.
  + ***Current*** - The time rate of flow of electric charge across a cross-sectional boundary
  + ***Voltage*** - work done in moving a unit positive charge once around the closed path.

1. Explain the following as used in atomic structure. (6 Marks)

* ***Atom*** - The smallest possible amount of matter which still retains its identity as a chemical element, consisting of a nucleus surrounded by electrons.
* ***Proton*** - Positively charged subatomic particle forming part of the nucleus of an atom and determining the atomic number of an element. It weighs 1 amu.
* ***Neutron*** A subatomic particle forming part of the nucleus of an atom. It has no charge. It is equal in mass to a proton or it weighs 1 amu.

**SECTION C (60 MARKS)**

***(These are suggested answers to act as guidelines.)***

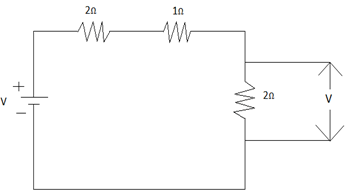
1. a. Explain the **two** types of Electric Circuits (4 marks)

* ***Series Circuits***— Series circuits consists of several devices, each of them linked up one after another after another in just a single large loop. Though, different devices have different voltages across them, the same current flows through every device in the series circuit.

If any one of the devices in a series circuit is broken, the whole circuit fails. For instance, if there are three light bulbs connected in a series, in just one loop of wire connected to a battery. If one light bulb is unscrewed, the whole circuit fails.

* ***Parallel Circuits*** —In parallel circuits, different devices are arranged so that a single source supplies voltage to separate loops of wire. The voltage in every device across the circuit is exactly the same, but in general different devices are going to see different currents. In this case, each device is going to work even if the other ones fail.

1. Calculate Voltage across 2Ω Resistor where supply v= 10volts. (4 Marks)



I = 10/5 = 2A  
V2 = 10(2) V2 = I.R2 = 2(2) 4V.

If there are 3 Resistors R1, R2 and R3 in series and V is total voltage and I is total current then Voltage across R2 is? (2 Marks)

V2 =I R2  
= V R2/ R1 + R2 + R3.

1. Discuss any **five** electronic components and their functions. (10 Marks)
   * **Resistors:** A resistor is one of the components you will come across in an integrated circuit. Like the name suggests, the device resists the flow of current. Resistors are graded based on their power ratings (amount of power they can handle without exploding) and resistance values (capacity to resist current). The measurement is done in units know as ohms. The electronic symbol of the unit is O.
   * **Capacitors:** These components can store electric charge temporarily. The components come in different varieties, with the most common ones being electrolytic and ceramic disk. The capacity of a component is usually measured in microfarads (ÂµF).
   * **Diodes:** Diodes allow electric current to flow in a single direction only. Each diode has two terminals known as the anode and cathode. When the anode is charged with positive voltage and the cathode with a negative one, electric current can flow. Reversing these voltages will prevent the current from flowing.
   * **Transistors:** These components are easy to identify through their three terminals. For the components to work, voltage has to be applied to one of them; the base terminal. The base can then control current flow in the two other terminals (the emitter and collector).
   * **Inductors:** These are passive components that store energy in form of a magnetic field. An inductor simply consists of a coil of wire wound around some kind of core. The core could be a magnet or air. When current passes through the inductor, a magnetic field is created around it. The magnetic field is stronger if a magnet is used as the core.
   * **Integrated Circuits:** An integrated circuit refers to a special device that has all the components required in an electronic circuit. The component has diodes, transistors, and other devices, all of which are etched on a tiny piece of silicon. The components are used in many electronic devices, including watches and computers.
2. a. List **four** types of number systems used in computers. (4 Marks)

* Binary number system (Base - 2)
* Octal number system (Base - 8)
* Decimal number system (Base - 10)
* Hexadecimal number system (Base - 16)

1. Convert the following to its

Binary to its decimal equivalent (2 Marks)

1. 110102

110102 = 1×24 + 1×23 + 0×22 + 1×21 + 0×20

= 16 + 8 + 0 + 2 + 0

= 2610

1. **(10110.001) (4 Marks)**

**(10110.001)2**=(1×24)+(0×23)+(1×22)+(1×21)+(0×20)+  
              (0×2-1)+(0×2-2)+(1×2-3)  
**(10110.001)2**=(1×16)+(0×8)+(1×4)+(1×2)+(0×1)+  
              (0×1⁄2)+(0×1⁄4)+(1×1⁄8)  
**(10110.001)2**=16+0+4+2+0+0+0+0.125  
**(10110.001)2=(22.125 )10**

1. **Hexadecimal to octal (2 Marks)**

**(152A.25)16**

**(152A.25)16= (0001 0101 0010 1010.0010 0101)2**

001     010     100     101     010.001     001     010

**(001010100101010.001001010)2= (12452.112)8**

1. **Hexadecimal to decimal (3 Marks)**

27FB16

= 27FB16 = 2×163 + 7×162 + 15×161 + 10×160

= 8192 + 1792 + 240 +10

= 1023410

1. Convert binary number 1101010 into hexadecimal number. (3 Marks)

First convert this into decimal number:

1. (1101010)2

= 1x26+1x25+0x24+1x23+0x22+1x21+0x20

= 64+32+0+8+0+2+0

= (106)10

Then, convert it into hexadecimal number

= (106)10

= 6x161+10x160

= (6A)16

1. Add 10111 + 110001 (2 Marks)

**Solution:**

**1 1 1**

            1 0 1 1 1

(+) 1 1 0 0 0 1

———————–

   1 0 0 1 0 0 0

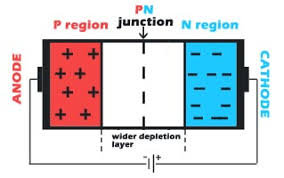
1. a. Define semiconductor. (2 Marks)  
   [Semiconductor](https://www.physics-and-radio-electronics.com/electronic-devices-and-circuits/semiconductor.html) is a material, which has the electrical conductivity between that of an insulator and conductor.
2. State five differences Between Intrinsic and Extrinsic Semiconductors (10 Marks)

|  |  |
| --- | --- |
| **Intrinsic Semiconductor** | **Extrinsic Semiconductor** |
| * Pure semiconductor | Impure semiconductor |
| * Density of electrons is equal to the density of holes | Density of electrons is not equal to the density of holes |
| * Electrical conductivity is low | Electrical conductivity is high |
| * Dependence on temperature only | Dependence on temperature as well as on the amount of impurity |
| * No impurities * The band gap between conduction and valence band is small. | Trivalent impurity, pentavalent impurity  The energy gap is higher than intrinsic semiconductor |

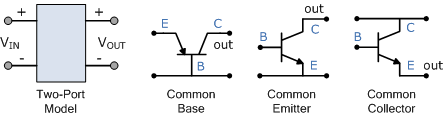
1. Explain the TWO types of extrinsic semiconductors? (4 marks)  
   [***N-type semiconductors***](https://www.physics-and-radio-electronics.com/electronic-devices-and-circuits/semiconductor/extrinsic-semiconductor/n-type-semiconductor.html) - N-type semiconductors are **a type of extrinsic semiconductor** in which the dopant atoms are capable of providing extra conduction electrons to the host material (e.g. phosphorus in silicon). This creates an excess of negative (n-type) electron charge carriers.

[***P-type semiconductors***](https://www.physics-and-radio-electronics.com/electronic-devices-and-circuits/semiconductor/extrinsic-semiconductor/p-type-semiconductor.html) - A p-type semiconductor is an extrinsic type of semiconductor. When a trivalent impurity (like Boron, Aluminum etc.) is added to an intrinsic or pure semiconductor (silicon or germanium), it is said to be a p-type semiconductor. Trivalent impurities such as boron (B), gallium (Ga), indium (In), aluminum (Al) etc.

c. With aid of a sketch, outline the PN junction diode showing the flow of current and depletion region formation. (4 Marks)



1. a. With aid of a sketch, outline the configurations mentioned in 5c above PN junction diode showing both the input signal and output (8 Marks)



1. Discuss any **six** challenges of emerging trends in electronic manufacturing (12 Marks)

* **Shrinking Operating Margins -** Global competition and new innovations are driving prices down. Companies must continually become more cost-efficient to remain profitable.
* **Complex Global Supply-Chain -** More and more, companies are having to juggle internal and external resources while staying within international standards. Issues such as traceability and compliance are increasing operational burdens. It is not unusual for components and sub-components to embark on a journey that touches three or more continents before reaching the end-consumer.
* **Service and Warranty Management -** Leveraging the global supply-chain is putting more focus on supplier quality management. Having a strong quality and traceability system directly affects warranty reserve and post-production service hours.
* **Short Product Lifecycles -** With quickly changing consumer tastes and preferences, EMS companies and contract manufacturers need to have effective New Product Introduction (NPI) processes in place. Closed-loop communication between sales, manufacturing, and engineering is vital to ensure product launches hit time, volume, and quality targets.
* **Uncertain Demand -** Aggregately, economic volatility and cyclical demand cause fluctuations in production. On a more granular level, consumer preference can cause spikes in demand for an individual product or company. Efficient lean capabilities must be in place to keep inventory aligned with demand.
* **Pressures mount for green electronics manufacturing -** “Being Green isn’t just for hippies and disaffected Xers any more. As climate change statistics continue to mount, there’s increasing pressure from *all*areas – consumers, businesses, and governments – to look into more eco-friendly manufacturing solutions.

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