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| NAME | JIBRAN |
| ID | 14472 |
| DEPARTMENT | BS (CS) |
| COURSE | Basic Electronics |
| SEMESTER | 4th |

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# Q(1) part (a)

Lower voltage devices are typically safer and requir less insulation. Small lamps and industrial controls are examples. The disadvantage is that more copper is required to conduct the greater current involved. Another advantage of lower voltage systems is that they may be powered by batteries.

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# Q(1) Part (b)

If you are troubleshooting, the ideal or the first approximation is usually adequate.

It is the simplest equivalent circuit for a device. For instances, the ideal approximation of a piece of wire is a conductor of zero resistance, This ideal approximation is adequate for everyday electronics work.

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## Q(1) part (c)

### Thevenin's and Norton's theorems

Thevenin's and Norton's theorem are important for circuit analysis as they are used to ~~simplify the circuit~~ simplify the circuit. Thevenin's theorem says that if you take any two terminal of a complex network you can replace the circuit ~~drastically~~ across it by a voltage source and a resistor in series. This simplify the circuit drastically. On the other hand in Norton's theorem the circuit is replaced by a current source and a resistor in parallel. So both the theorems are important and essential part of circuit analysis.

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# Q(2) part (a)

If the transformer's turn's ratio is 1, the peak value of the rectified output voltage equals half the peak value of the primary input voltage less the barrier potential. This is because half of the primary voltage appears across each half of the secondary winding $V_{p(sec)} = V_{p(pri)}$.

In order to obtain an output voltage will a peak equal to the input peak (less the diode drop), a step-up transformer will a turn ration of $n=2$ must be used. In this case, the total secondary voltage ($V_{sec}$) is twice the primary voltage ($2V_{pri}$), so the voltage across each half of the secondary is equal to $V_{pri}$. The output voltage of a center-tapped full-wave rectifier is always one-half of the total secondary voltage less the diode drop, no matter what the turn's ratio.

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# Q(2) Part (b)

## Center Tapped Rectifier:-

A center tapped full wave rectifier is a type of rectifier which uses a center tapped transformer and two diodes to convert the complete AC signal into DC signal. Load resistor, an AC source, two diodes and a center tapped transformer are the main components of a center tapped full wave rectifier

## Bridge Rectifier:-

A bridge Rectifier is a type of full wave rectifier which uses four or more diodes in a bridge circuit configuration to efficiently convert the AC into DC. Bridge rectifiers are widely used in power supplies that provide necessary DC voltage for the electronic components or devices.

## Q(2) part (C)

### Advantages:

| RC filters | LC filters |
|---|---|
| (1) Reduce size and weight. | (1) The choke input (LC) filter has a high output D.C voltage. |
| (2) increased reliability and improved performance. | (2) It has very good load regulation. |
| (3) In large quantities, the cost of an IC is less than its passive counterpart. | (3) It has no loading effect on the rectifier and power transformer. |

### Disadvantages:-

| RC filters | LC filters |
|---|---|
| (1) limited bandwidth of active devices limits the highest attainable frequency (passive RC filters can be used upto 500 MHz) | (1) It can not be used together with half wave rectifier. |
| (2) require power supplies (unlike passive filters) | (2) It is not useful for very low load current. |
| (3) Increased sensitivity to variations in circuit parameter caused by environmental changes compared to passive filters. | (3) It has low output D.C voltage than that of π type filter |
| | (4) It has high ripple factor than that of π type filter. |

## Q(3) part (a)

When a diode is reverse biased, the width of the depletion region increases. Minority carriers of each material are pushed through the depletion zone to the junction. This action causes a very small leakage current to occur.

## Q(3) part (b)

A LED is a semi-conductor light source that emits light when current flows through it. Electrons in the semi-conductor recombine with electron holes, releasing energy in the form of photons.

## Q(3) part (c)

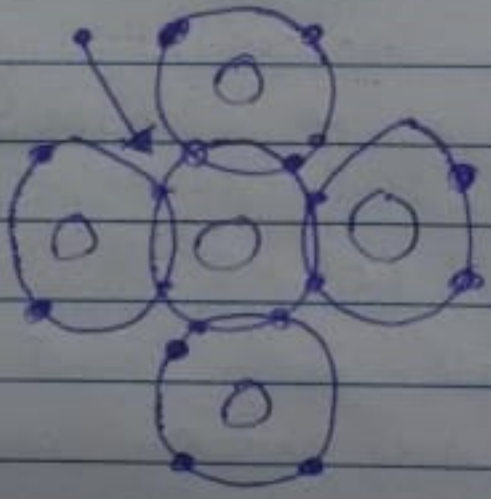
No, they are not just vacant spaces. Whenever holes are moving around, it's actually the bonding-electrons which jumps between neigbors. Those aren't free electrons, not movable electrons. Usually they cannot move. They are called "valence electrons", and they remain still as they hold the crystal together.

When they reach the end there is a wire that will conveniently supply an electron to fill that hole.

## Q(3) part(d)

In a pure silicon crystal, the thermal energy creates an equal number of free electrons and holes. The free electrons move randomly throughout the crystal. Occasionaly, a free electron will approach a hole, feel its attraction and fall into it. This is known as recombination. Because of this recombination energy is released.

Recombination of free electron and a hole:



## Q(3) part (e)

Surface leakage current is nothing but a current due to outer surface of diode and it follows ohms law. In forward biased surface current does not show any effect because of low resistance of diode. But it does have an effect on a reverse biased diode.