Basic Electronics
BS-SE (13)

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Question 1:

a) Answer: If the transformers turns 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 with a peak equal to the input peak a step up transformer with a turns ratio of n = 2 must be used. In this case the total secondary voltage is twice the primary voltage so the voltage across each half of the secondary is equal to Vpri.
In any case the output voltage of center tapped full wave rectifier is always on half of the total secondary voltage less the diode drop no matter what the turns ratio

$$V_{out} = (V_{sec}/2) - 0.7V$$

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b) Answer:

Center Tapped:

- A centre tapped rectifier is a full wave rectifier which uses two diodes.
- Peak Inverse Voltage is 2 Vs max
- Transformer Utilization Factor is 0.692
- Voltage regulation is better
- Transformer Requirement is mandatory for centre tapping
- Voltage Drop across diode is Low
- Circuit Complexity is less

Bridge Rectifier:

- A Bridge Rectifier is a full wave rectifier which uses four diodes connected together in the architecture resembling a wheatstone bridge.
- Peak Inverse Voltage is Vs max.
- Transformer Utilization Factor is 0.812.
- Voltage regulation is good,
- Transformer Requirement is discretionary or not essential.
- Voltage Drop across diodes is high due to the presence of four diodes.
- Circuit Complexity is more.

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c) Answer:

The RC filters are only useful for small load currents, More power dissipated in RC filter. It has poor voltage regulation and is cheaper. It also requires ventilation to conduct away the heat produced in the resistor and high ripple factor. RC is fine for filtering low power signals.

The LC filters are useful for heavy load currents, Less power dissipated in LC filters. It has good voltage regulation and is costly. It does not require any ventilation because the heat is not produced in the inductor and It has low ripple factor.LC is fine for filtering high power signals.

Question 2:

a).

Answer:

50 Ohm voltage source is the maximum power transfer that occurs when the load has a resistance of 50 Ohms. Similarly, 600 Ohms is required for max power transfer into an impedance that presents itself as 600 Ohms. We need to maintain the integrity of the impedance at all points if you are to avoid reflections down the line and damaging the output PA.

So,We had an antenna rated at 50 Ohms connected to a 50 Ohm feed then all things being equal min SWR etc you be better with 50 Ohms source. Some configurations of antenna may be seen as presenting an impedance of say 580 Ohms in which case the 600 ohm may be the closest and best alternative. However, the loads need not be in radio engineering.

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b).

Answer: For the process of troubleshooting, preparing the circuit diagram is the initial and basic process performed by the maintenance technician, the components can be physically interconnected to each other using solder, wire wrap and printed circuit board methods.

Any electronic system consists of an element component assembly and equipment. All these parts together make a complete electronic system. The troubleshooting process consists of fault establishment, fault location and fault correction.

c).
Answer: Thevenin's and Norton's theorems are important for circuit analysis as they are used to simplify the circuit. Thevenin's theorem says that if you take any two terminals of a complex network you can replace the circuit across it by a voltage source and a resistor in series. This simplifies 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 theorems are an important and essential part of circuit analysis.

Question 3:

a).
Answer: An important conduction limitation of PN junction diode is leakage current. When a diode is reverse biased, the width of the depletion region increases. Generally, this condition is required to restrict the current carrier accumulation near the junction. Majority current carriers are primarily negated in the depletion region and hence the depletion region acts as an insulator. Normally, current carriers do not pass through an insulator. It is seen that in a reverse-biased diode, some current flows through the depletion region. This current is called leakage current. Leakage current is dependent on minority current carriers. As we know that the minority carriers are electrons in the P type material and holes in the N type material.

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b).
Answer: Light emitting diodes produce light by the movement of electrons between the two terminals of the diode, which occur by a process called electroluminescence. When a light emitting diode is electrically connected, electrons start moving at the junction of the N-type and P-type semiconductors within the diode. When there is a jump over of electrons at the p-n junction, the electron loses a portion of its energy. In regular diodes this energy loss is in the form of heat.

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c).

Answer: Holes do not flow in a conductor. Conductors allow current flow by virtue of their single outer-shell electron, which is loosely held. When holes reach the end of a semiconductor,they are filled by the conductor's outer-shell electrons entering at that point.

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d).

Answer: The current in a p-n diode is due to carrier recombination or generation somewhere within the p-n diode structure. Under forward bias, the diode current is due to recombination. This recombination can occur within the quasi-neutral regions, within the depletion region or at the metal-semiconductor Ohmic contacts. Under reverse bias, the current is due to generation. Carrier generation due to light will further increase the current under forward as well as reverse bias.

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e).

Answer: It is a reverse current on the surface of the crystal. Suppose that the atoms at the top and bottom of are on the surface of the crystal. Since these atoms have no neighbors they have only six electrons in the valence orbit, Implying two holes in each surface atom. Visualize these holes along the surface of the crystal. Then you can see that the skin of a crystal is like a p-type semiconductor. Because of this electrons can enter the left end of the crystal, travel through the surface holes and leave the right end of the crystal. In this way we get a small reverse current along the surface.