Basic Electrical Circuits
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Lecture – 07

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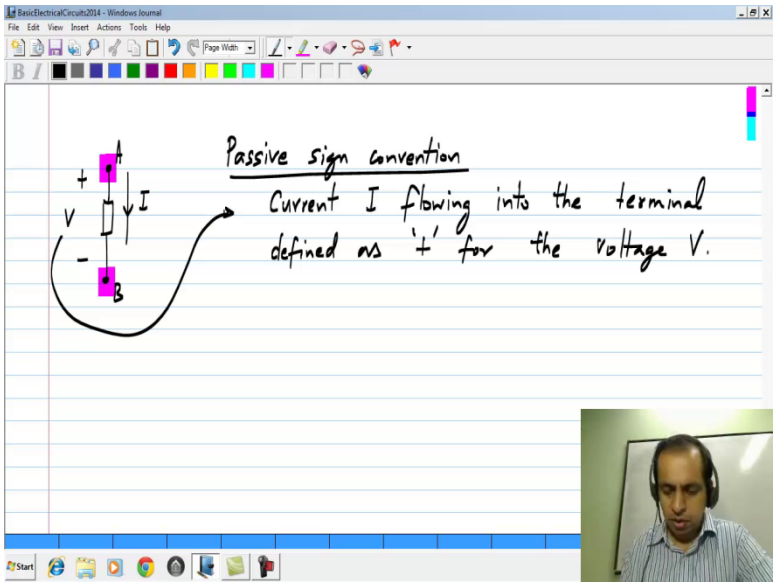

In this unit, we will be looking a number of basic elements that are used in circuits. Now when we have an element, we will start with two terminal elements. So this shows an arbitrary element, and it has two terminals A and B. Now as we said earlier as we discussed earlier these elements are described by relationship between the voltage across the element and the current through the element. So, now, there is a particular convention that is used for defining the current and voltage that is known as the passive sign convention. What it means is that we define the voltage with some polarity, say we choose A to be positive, and B to be negative.

Now of course, it does not mean that the voltage is positive this way, this is the way we define the voltage. If we define the voltage like this then the current I should be defined as going into terminal A that is whichever terminal is defined as the positive for the voltage. Current I is flowing into the terminal defined as plus for the voltage V. We will see later why this is called passive sign convention when we come to power and energy, but this is the convention that we will use otherwise there will be some ambiguity, I mean if we take I is the other way then it will be negative of whatever I we take this way.

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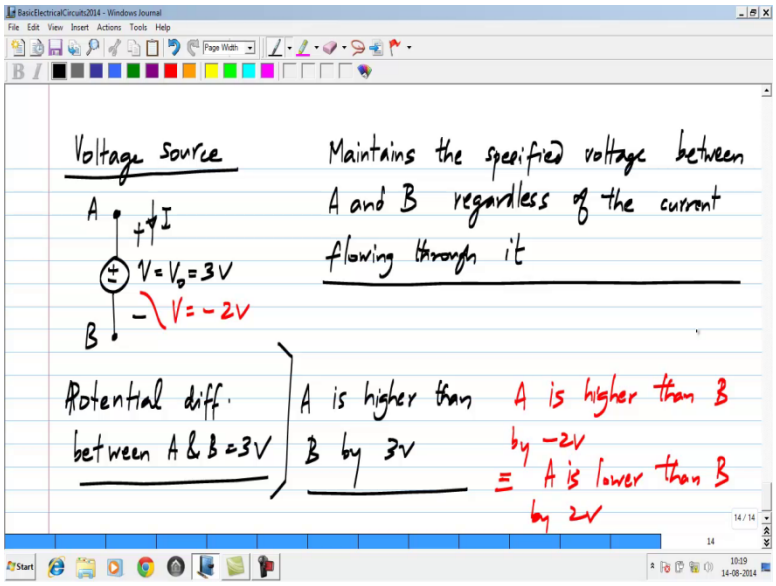

With definition let us go to the first of our elements which is a voltage source. Voltage and current have the basic electrical quantities and there are sources which establish a given value of voltage or current and the voltage source establishes voltage difference between two terminals. It is given by this symbol with polarity indicated inside. What does it mean it means that the voltage between these two terminals A and B measured in this way which is given by the polarity inside a is a certain V naught, this is the specified voltage. Let say for instance, let us take this to be 3 volts. What it means is that the potential difference between A and B is 3 volts or in more specifically point A is higher than B by 3 volts.

Now again I want to emphasize that the polarity shown here is for the definition of the voltage the voltage itself could be positive or negative. Let me take another case where V defined this way is minus 2 volts what it means is that A is higher than B by minus 2 volts which is equivalent to saying a is lower than B by 2 volts. And the property of voltage sources that it maintains the specified voltage between A and B regardless of the current flowing through it, so it does not matter what the values of I is the voltage between A and B is maintain to be 3 volts or whatever V naught is. And this voltage could also be depends on time though in most of this course, we will be looking at voltages which are constant with time. It could very well be a voltage source which has a time depend volts is that is very much possible. All it means is that the voltage difference between A and B is that function of time.

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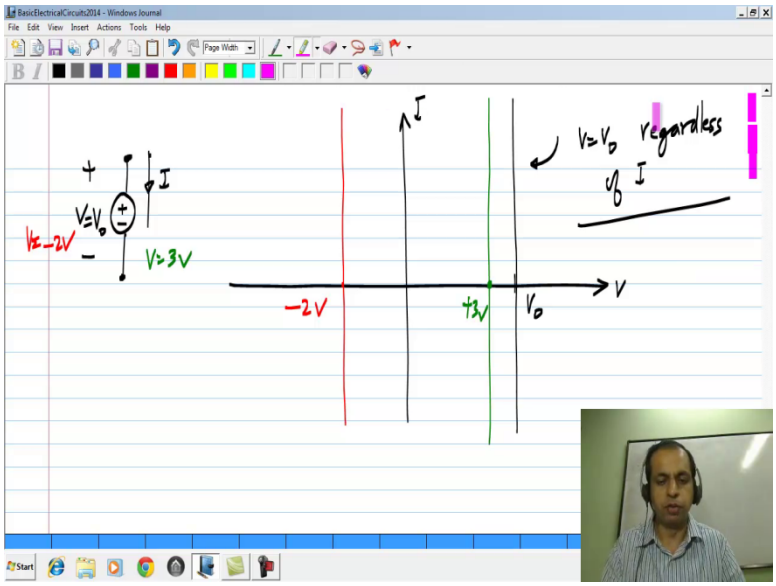

Now, when we have V and I like this; it is common to graphically depict the relationship between V and I, wherever possible, because as the picture is what the thousand words. It is useful to imagine these characteristics graphically and sometimes you can also carry out useful calculations with this. Now generally it is common to draw current as the function of voltage that is what we will be using for other elements; we could also draw V on the vertical axis and I on the horizontal axis. Now as I just said the property of the voltage source V is that it maintains a constant voltage between these terminals, this V will be a constant regardless of the current flowing through it.

So let say this V is given to be some V naught; and V naught happens to be positive the characteristic will look like this. What is it say V is always equal to V naught so that means, that the characteristic is the vertical line like this. Now if V happens to be minus 2 volts then this vertical would be at minus 2 volts; if V happens to be 3 volts, the vertical line will be at plus 3 volts. So this is what the characteristic of a voltage source looks like graphically. This voltage source will be used in circuits to establish a certain voltage between some given terminals.