Basic Electrical Circuits
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Lecture – 02

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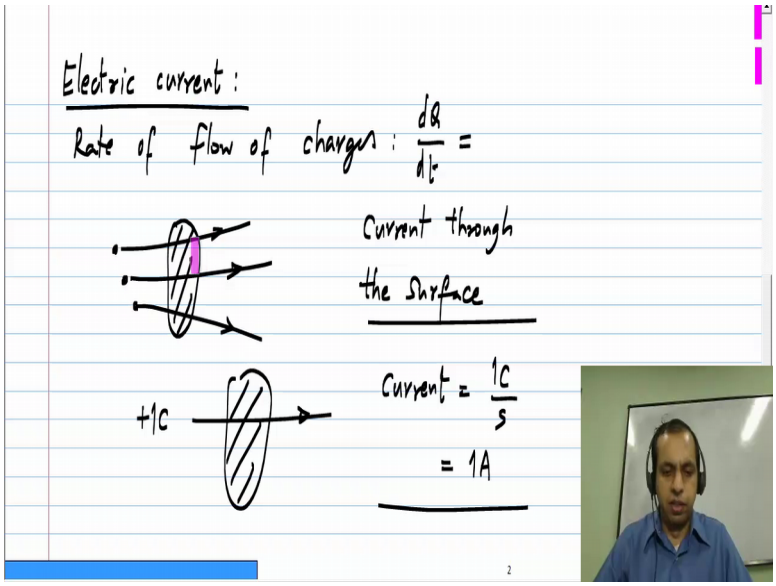

Now have to do this first let us look at the relationship between charges and fields, and currents and voltages. So what is an electric current, electric current as you well know is basically the rate of flow of charges that is if you have a certain surface and some charges have moving in this direction. So let say these are some positive charges, and the rate of flow of charges which is basically dQ by dt across a certain surface is the current through the surface. So if you have let say 1 coulomb charge that is plus 1 coulomb charge and that happens to cross the surface in 1 second that is over 1 second a total of 1 coulomb of charge crosses the certain surface then the current will be rate of change of charge, which is 1 coulomb per second which is given the unit of 1 ampere.

Now, you also very likely know this for historical reasons, current is consider to be the flow of positive charges, because all these things done before atomic structure of matter was discovered, so even though we know now that it is the electrons that are moving, there are no positive charges that are moving when we say a certain positive charges moving from left to right, it is really electron that is moving from right to left at least as for electrical circuits are concern. So even though we know that is true we still define the current as rate of flow of positive charges, because that is the convention. So you should if you want to get a physical

picture of this, you should imagine electrons moving in the opposite direction. Now this is the very general definition of current and depending on how charges are moving across the surface, you can compute the current by looking at how much charge is moving across the surface in 1 second.

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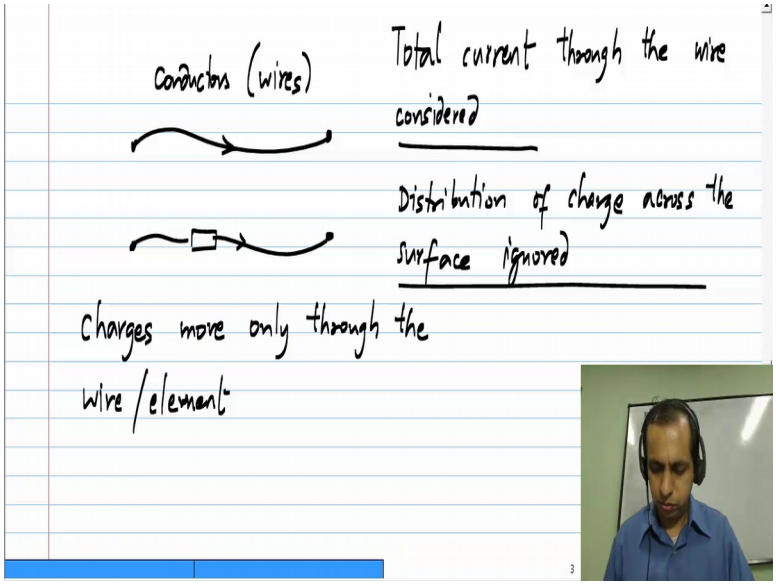

Now, in case of electrical circuits, it turns out that we will have certain conductors which are you can think of them as wires or you could have some electrical elements. It turns out that the charges move only through these wires or through the wires connected to the element, and through the element itself. And we will concern ourselves with the total charge that is moving through wire and we would not worry about exactly how it is distributed across the surface of the wire. Now there will be some advance circuits in which this may we have concern, but most of the circuits can be dealt with by completely ignoring how the charges are distributed across the surface of the wire through which the charges are flowing and considering only the total charge flowing through the wire.

So, like I said earlier, if you ignore the spatial extends of the problem spatial distribution of charges or fields things become immensely simple compared to problems in electromagnetic. So the first thing is that we will only worry about the total amount of charge that is flowing through the wire or basically the total current flowing through the wire, so that is one simplification. Now this is possible, because we can have this wires and charges flow only through this wires and the current or any charge flow outside the wires can be considered to be negligible. There are lot of very useful context in which this assumption holds very well, so we can make this assumption safely.

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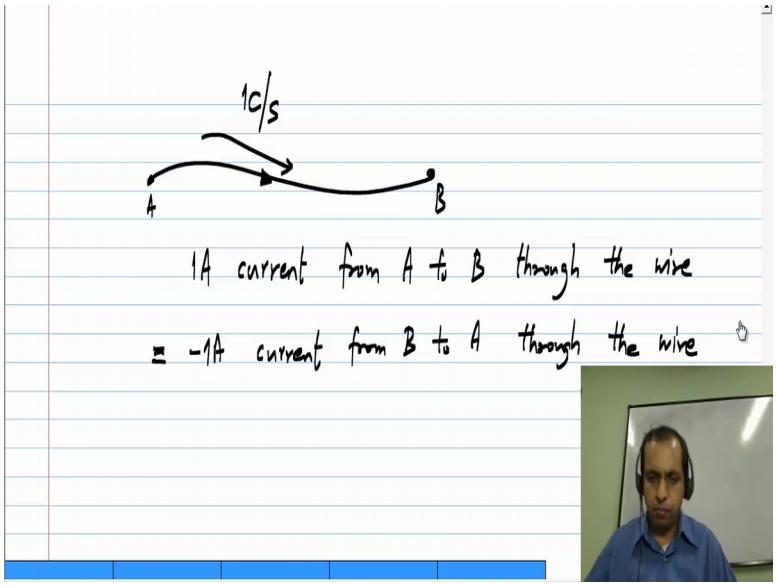

Let say we have wire and we have 1 coulomb per second of charge flowing in this direction. So what does this mean, this is 1 ampere current from A to B through the wire which is exactly the same as the minus one amp current from B to A through the wire. Now again this is quite obvious, but the reason I am writing this is as you solve for circuits, you will encounter both positive currents and negative currents, and you should become very comfortable dealing with either one of the polarities. So in any element, if you take 1 ampere of current in one direction, it is exactly equivalent to having minus 1 ampere of current in the opposite direction. So you should not get uncomfortable or unconfused with polarities of currents.