Surveying
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Module - 3
Lecture - 2

Linear Measurements

Welcome again! This is the video series on basic surveying and right now we are doing module three and in module three we have already done lecture number one. Today we will be talking about lecture two and this lecture two will be from linear measurements.

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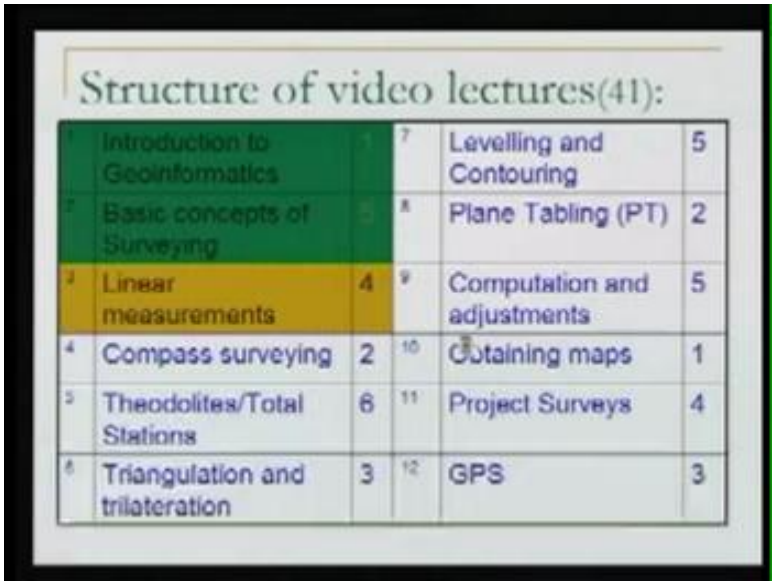

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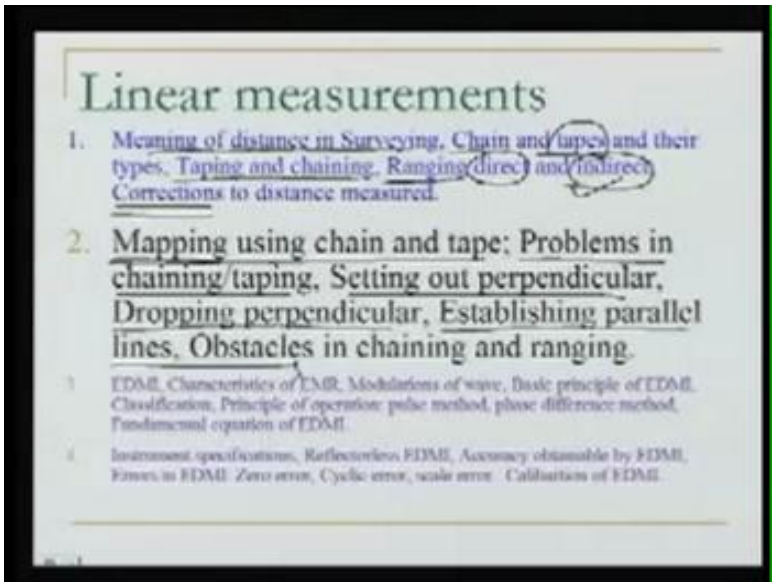

What all we have done so far in our lecture one of module three? We talked about the meaning of distance in surveying, we said whenever we mean distance, whenever we mean the horizontal distance, unless it is specified we do measure sloping distances, but ultimately for our purpose we convert these sloping distances to the horizontal equivalent or if not horizontal then on the geoid depending on what kind of surveying we are doing: plain surveying or geodetic surveying. Then we saw some instruments, we went to the field also and we saw some of the instruments, for example the chain and tape, we saw how the chain was made it; was very flexible, how to fold it, how to unfold it, how to measure the lands with the chain. Also we saw various types of the tapes, what are their purpose why do we use the tapes then we saw the operation of taping and chaining. How can we measure very accurately with these instruments, particularly the tape? Tape is very precise; we can measure very precisely and very accurate distances using the tape. There are certain procedures, which we need to follow so this is about we have seen. We also saw one more important point that was the ranging. The meaning of ranging was if we have a length, which is longer than the length of a single tape or chain in that case we cannot spread our chain or tape in that entire length.

So what we have to do? In that total length we have to put our chain or tape multiple times so when we are putting it multiple times. We need some intermediate points in between those two points between which we are measuring the distance. So putting these intermediate points in between this operation is called the ranging. We saw some methods, how can we do it directly is a simple case. In case of the indirect if these two points are not inter visible because of certain reasons, you can still establish some intermediate points by indirect ranging method. Then very important thing was the corrections in your tape or in your chain. There is a length written. Okay. Thirty meter is the designated length. Now we are going to the field. When you are working in the field is that tape really thirty meter? There should be question mark? The tape says it is thirty meter, it is written their but while we are working in the field in actual field conditions is it really thirty meters? It might change because of various reasons: the temperature in the field is more than the temperature at which the tape is a standard.

The pull which we are applying is more than the pull at which this tape is a standard. So because of these reasons, what will happen is the actual length of the tape, while we are working in the field, is different than the designated length. Now because of this we need to apply corrections whatever measurement we are taking in the field if we don't apply the corrections for this difference in designated and actual length our observations will be wrong Now what we will do today, we will see a very important thing that is mapping. Mapping using chain and tape. We will try to make use of chain and tape and we will do a little exercise here itself about how we can a make a map. Then we will see what are all the common problems in chaining and taping, how do we set out perpendiculars. Will need to set out perpendiculars, we will see it in course of the lecture. We will see also how to drop the perpendiculars. This is also required; whenever we are working in the field we chain and tape we are taking observations. We need to set out perpendiculars or erect the perpendiculars. We need to drop the perpendiculars also. Then we will also see some methods of establishing parallel lines and some obstacles in chaining and ranging. So this is what we will do today.

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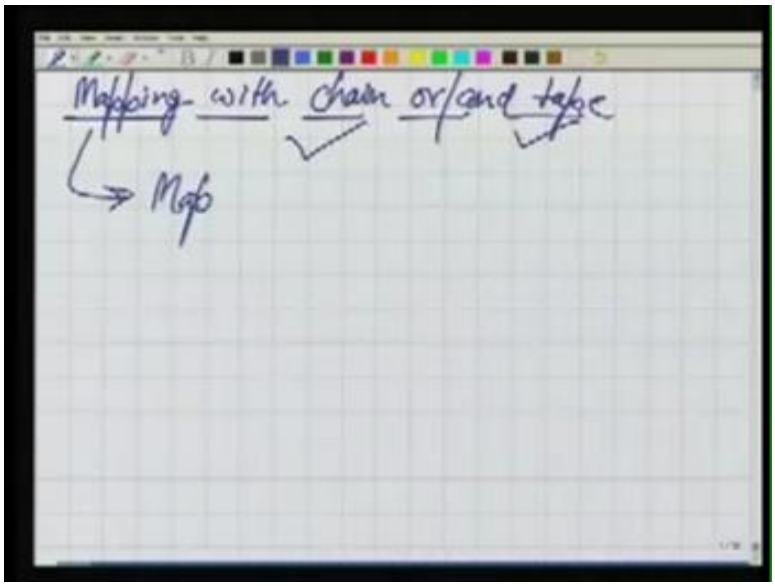

So to begin with we will see how we can make a map with chain or tape. So we will write it is as mapping with chain, I can say or and tape. Now in in order to solve this problems first let us see what is the meaning of a map we already know we have already discussed what is the meaning of a map. A map is the representation of ground or terrain in our sheet or we can say otherwise the map is representation not only on sheet but also on a computer screen. We are bringing the terrain some way into our computer so can we can do various kinds of works on that terrain. So a map is the representation of the ground or terrain on a sheet or on the computer. Now how to make that map. We will see now with the help of chain and tape. What I will do for that I will start with a diagram here. Now this diagram shows for example let us say, There is a garden and this is the boundary of the garden and this ground is around forty meter in width and let us say hundred meter in length approximately now you can visualize this kind of garden a kind of a strip in a neighborhood somewhere.

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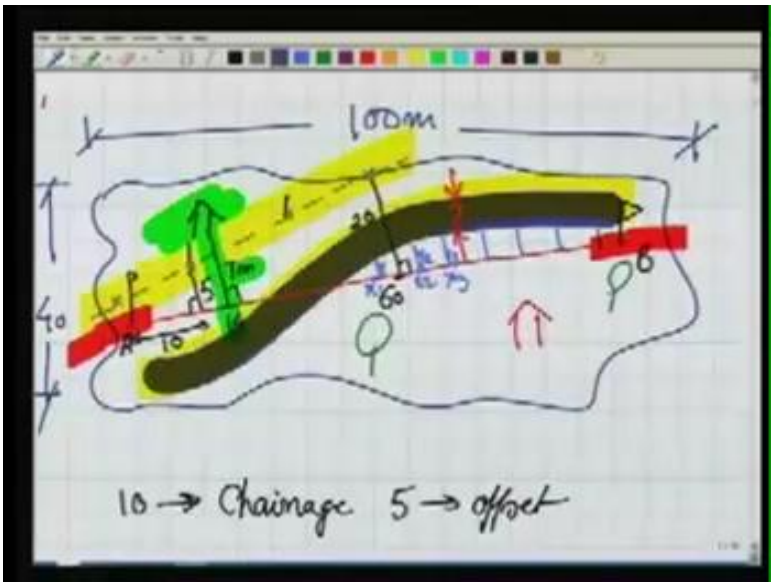

Now in this garden there are varieties of things. For example let us say there is a road well then, in addition there are some houses: one, two some little huts or some houses are their also in addition to this there are some trees. Here is a tree, there is another tree. Also may be there is a telephone line a telephone line passes through this garden. This is pole number one, pole number two, pole number three and so on. This is my ground. Okay? Any ground could be like this. Now we want to make a map of this and we want to make use of chain and tape for this purpose. So, we will see what should be the procedure, what are all the various steps in order to make a map of this. So, I will start step by step.

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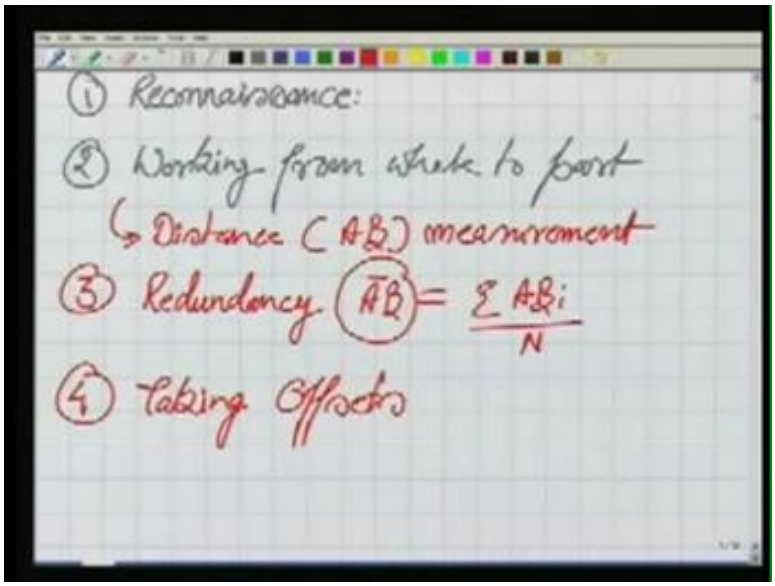

Number one, as you know, is reconnaissance. What is the meaning of reconnaissance? We go to our area, we observe our area, we make a rough sketch of area and we decide what strategy we are going to make use of in order to make the map. So we do the reconnaissance and then the principle number two that is about working from whole to part. We have discussed that and we will see how we are going to implement this principle when we are making this map. Now in working from whole to part, how do we implement it here? First of all we decide about some two locations because we are making use of chain it will become very clear to you very soon. Let us say I decide, well in my area if you see here, I select a point somewhere. For example let us say here this, I say, a point A. I put a ranging rod at this point. This is my control point or survey station. Then I choose another control point somewhere here, which I say as B. I put another ranging rod here.

So these two are the ranging rods. Now there could be an imaginary line between these two points. Let me draw the line in red colour. There is no physical line in the ground but this line is marked with the presence of these two ranging rods. So job number one, when we are going to the field, is the connections locating these two points A and B, where these points could be. Once we have located these two points job number two in working

to whole to part is we want to measure the distance between point A and point B. Using chain or tape we already know how to measure the distance as you can see over here. This distance A and B is of odd of hundred meter. So you will need to do the ranging, so we do ranging and by doing the ranging we measure the distance between A and B. So one step here is important step distance or the length AB, measurement you can measure it using tape or using chain. Another principle which we are going to make use here we measure the distance not only once, we measure it we start from B towards A. We take couple of measurements.

We start from A, go towards B. Again we take couple of measurements. So for the same length AB you end up having five measurements, ten measurements and so. So having all these measurements together what you are doing is you are following one principle that is maintaining redundancy in the observation. Well by doing this redundancy your final AB the length of AB is actually the mean of all these AB is measured divided by the number if times it was measured. So this is the mean length. This is the mean length means you are more sure about the correctness, the accuracy of this. Mean length well we know. Thus AB measured, now what is the next step? The next step will be, the step number four that is about taking offsets. Now what are these offsets? Before going to the offsets I would like to give you one more term and this term is called field book. Whatever we are doing in the ground, we will take all those observations and record them in the field book. The field book is nothing but a small book and you can work in the field you use your pencil to write on the field book and you can write on that field book.

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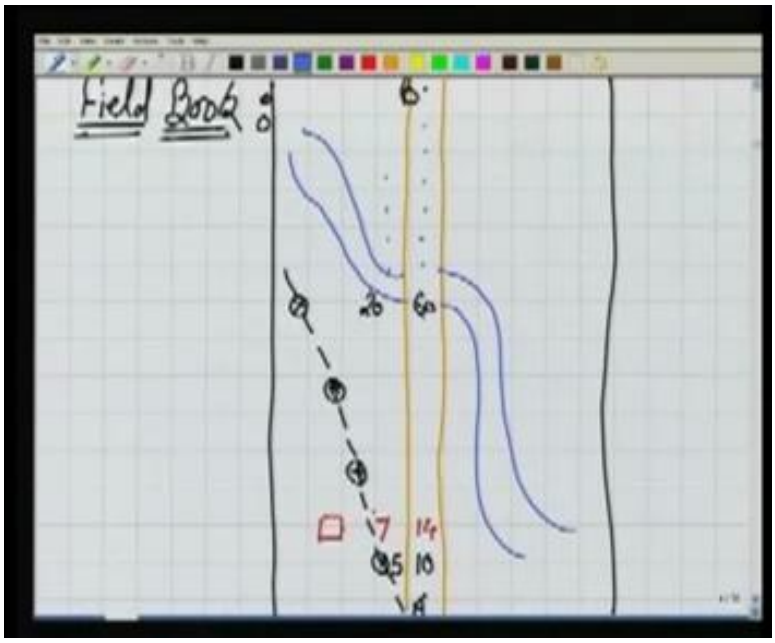

A typical page of the field book may look like this. This is the single page of the field book. Okay. It is of around this size and it will have two very faint lines in between by red colour. Now we will very soon will see what is the purpose of this. Why we are going to have a field book like this? We go to the field with this field book and we can hold it in our hand and we can start writing on that with the pencil. Well in this field book if you look at the ground we have measured the distance between A and B. A and B are our survey stations. So in the field book, what we do, first of all we mark a point here as A and we mark another point as B. So one page of the field book. It is nearly equivalent to the length AB so we will maintain this ratio. Whatever we are doing, in the field book henceforth, we will maintain this ratio.

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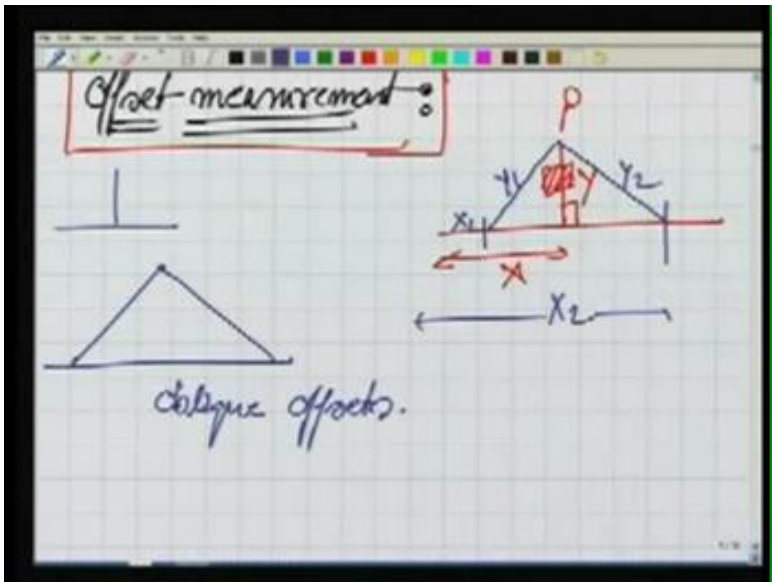

Well going to the offsets. Offset measurement. What it is, how do we do it and why do we do it? There in the field, if you look at the drawing, there in the field, once this length is established I can walk along this line everywhere. I can walk along this line. Now how do we take the offset? Okay. I walk along this line let us say a length ten meter, then over here is one telephone pole and from this telephone pole I drop a perpendicular on my length and this perpendicular length is five meter. I take this measurement because I am walking along the chain. The chain is spread here for example. So I know this length, which is ten meter. I have dropped perpendicular from the telephone pole on this line on this chain and it measures five meters. Now how do I record it to record this this ten meter? I am measuring along the chain. We say this as chain is this five meters because we are making use of five meter in order to locate the position of a telephone pole.

So all these measurements, which we use in order to plot the details whether we are talking about the tree or the house or the tree or road or anything. all the measurements which we take with respect to the chain line to plot these details are called the offsets. so this is offset. Now how do we record it? to record it in the field book, if you see in the map, you start walking from A to B. this offset at a chainage of ten is towards our left hand side because you are walking from A to B. so on your left at five meter you have a

an offset of five meter. So starting from A I told you this is the length. here is approximately hundred meter so we will try to maintain that ratio. So whenever you are working in the field with the field book and you are sure that ratio is maintained so at around ten meter; ten meter will be somewhere here at ten meter of chainage, you have an offset which is five meter towards left so five meter towards left is a telephone pole well so this is the record of telephone pole in my field book. I write it down five here. I go back to the map in order to plot this entire telephone line let us say.

This telephone pole is again, if I drop a perpendicular a perpendicular, will be somewhere here and this length is, let us say sixty meter. It starting from A to the foot of the perpendicular is sixty meter. So what I can do in my field book at sixty meter chainage, as you can see here we have a perpendicular length, which is twenty meter. Okay, length of the perpendicular is twenty meter. So at sixty meter on my left hand, twenty meter. So this sixty is the chainage that is why it is being written along the chain line. This twenty is the offse.t it is being written on the side and I make another symbol for the telephone line. This is not the exact symbol but I am just using so that you can understand it right now. In our field book we also join these because there in the field we can observe our telephone line is a straight line. So I can joint these like this again. In the field you can see that the poles along the telephone line are equal distance. We can measure one of these distances, let us say, the distance between these two poles . If we have measured these distances I can establish well my other poles should be here and so on. So all these poles are located in my field book. Field book is just a rough representation of the field but it has all the observations. Twenty offset, sixty chainage; five offset, ten at chainage.

Well we go for some other objects let us say a house I take the red colour now this house again is at certain distance so for the house I again drop a perpendicular here on the chain line once the perpendicular has been drop I measure the distance from A to the perpendicular to the foot of the perpendicular let us say this distance is fourteen meter and perpendicular is seven meter what is the meaning of that In my field book at fourteen chainage we said it is. Again if I am walking from A to B it is on my left. This is on my left so from walking from A to B on my left at seven meter. So I am writing seven here.

So what is the meaning of this the: fourteen is the chainage, seven is the offset and there is a house, this is symbol for the house, so I am writing it in my field book. Similarly you can do it for the road. As you can see in the case of the road, how many offsets you need to take in case of the straight telephone line? For example, here starting from here if I highlight it, thus my telephone line which is straight so, because if is straight I just need to plot two points and rest of the intermediate points of the telephone line can be plotted automatically, but here in case of the road as you can see it is curvilinear; is not in straight. So how many offsets should I take? Well the number of offsets that I should take will depend upon how accurately we want to plot it. Just for this length here, for example let us say I measure the width of the road. The width of the road is measured in the field you say. Okay? The width of the road is seven meters, then you start taking number of offsets. Number of offsets means all these perpendiculars.

Now at certain chainage x_1 this is y_1, at x_2 it is y_2, at x_3 it is y_3 and so on. So what do we see in the field book? We will write it like this at all the chainages. We have certain values of the offsets and the road goes like this because we have done all these measurements. We also know the width of the road. We had measured the width of the road, so I can show this width also here. So my rest of the road will be like this because we have taken the offsets so by doing this. My field book is ready. As you can see here in the field book all these details are shown as well as the observations the chainages and offsets are given. Next, what can I do?

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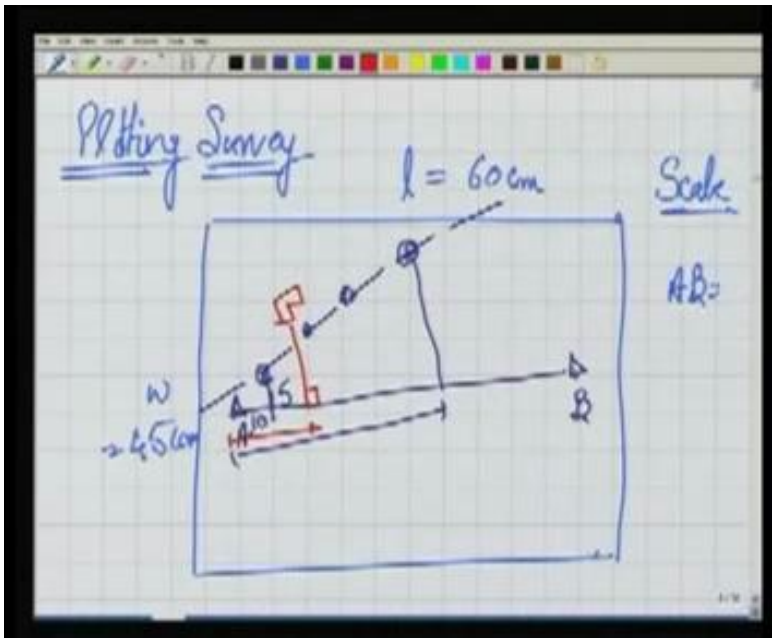

I can go for the plot. I can plot my survey now from the field book because this is what you bring to the office. After bringing the field book to the office you do the plotting. So how to make use of field book? Well we start with again, in my field book there are two stations - A and B, which are at certain distance. We have already measured the distance between A and B which was some value. So in my plot this is the drawing sheet. Drawing sheet will have certain dimensions, some length, some width. Let us say it is sixty centimeter and this is forty five centimeters. First of all my ground was hundred meter and forty meter wide while my drawing sheet is small so definitely we have to decide a scale. So that the entire ground can be fit to this drawing sheet once that the scale has been decided what we will do our AB length which was measured in the field. I will convert it to the scale and then I will plot this A and B here.

Let us say I plot A and B. That is my A and this is my B. I can again draw a line between these two. Then I go back to my field book. I observe in my field book well moving from A to B at a distance of ten chainage, there is an offset of five meter, which is for a telephone pole.

So I do plot this going from my chain from A to B at a distance of ten meter. I can measure ten meter. Here we have a perpendicular offset at five meter and that is for a telephone pole similarly I can also plot the another telephone pole because I know it's chainage, I know it's offset. So another pole will be plotted. I know my telephone line is straight, I can join it. I know the telephone poles were at certain interval, I can plot the rest of them. Similarly, I can plot the was houses, okay? Because I knew the perpendicular offset as well as the chainage for the house so whatever map will look like.

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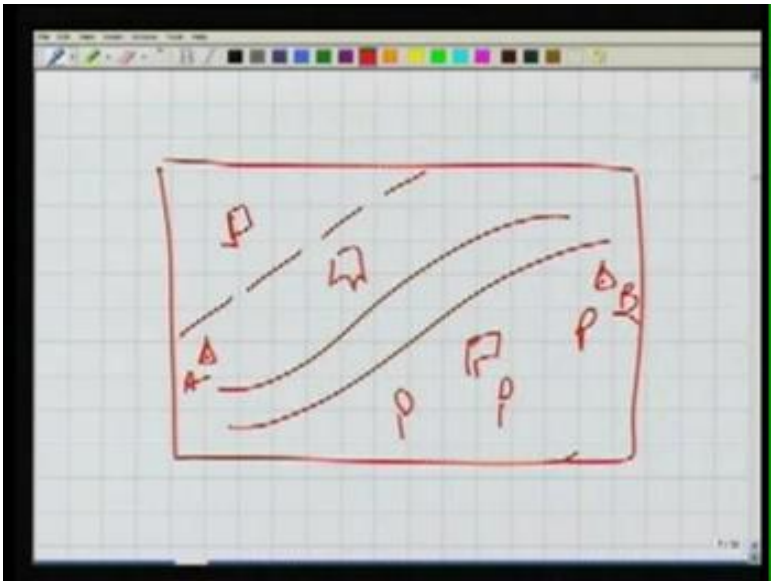

The map finally will look like will have the road will have the telephone line will have the trees will have the houses and as well as we like to put these two control points A and B because we can make use of these control points later on for some other purpose. So this is how my map will look like. So what we have seen? We have seen the entire process of making a map using chain and tape. There are many things which we need to look into. Number one was we have not seen in detail this offset measurement. Depending the ground the offset measurement could be different. So far what I was saying we have the chain line any tree or any object. In order to plot it on the chain line I will drop a perpendicular, I will measure the chainage x and the perpendicular offset y and I can plot it. I can write it on the field book but dropping this perpendicular may not

always be possible. If that is the case, let us say there is a tree or there is a water pond. We cannot drop the perpendicular, we cannot find the perpendicular height. What to do in that case? Well if that is the case there could be, we can drop; we can have two lines like this I know the chain is for this point x_1, I know the chain is for this point x_2 and I know this length as y_1 and this length as y_2. So this kind of offsets the first one, which is perpendicular are called perpendicular offsets. The second one in which we have the oblique lines it is called oblique offsets. So this is how we can take the measurements. Well, something more about taking the offsets. If this is my chain line, we have seen there is a feature, which is variable as to how to take the offsets. We can take the offsets wherever the feature changes its direction.

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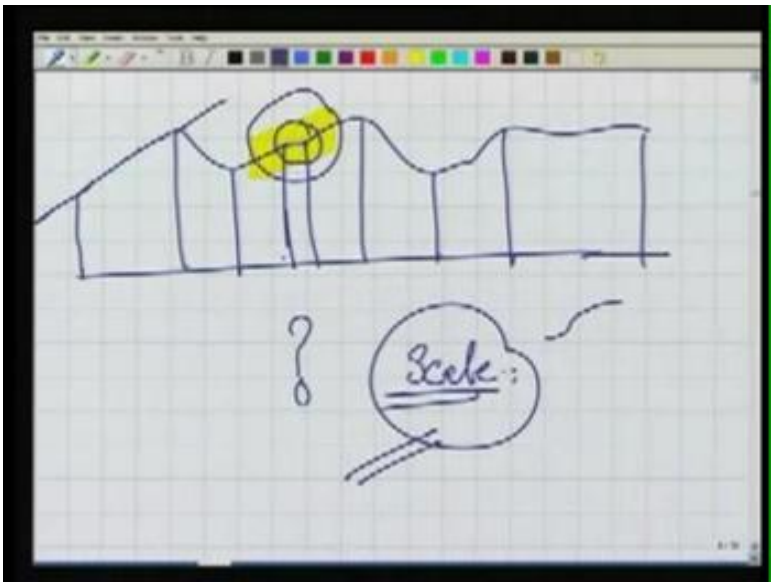

We can consider all these points for taking the offsets. We need not to take the offset at each and every point because it is a straight line. Here for example there is a certain variation in my feature. If it is a hedge this does change its direction a little bit over this area. Over here I should take offset. Also here that is a question mark? Should I take my offsets also here to represent this variation? This depends upon how accurately you want to represent the ground onto the sheet if you are concerning you want to represent each and every variation of the hedge yes we should take an offset. It also depends upon the

scale, what is your scale, because you will remember we are talking about the plotting accuracy. Can this little variation be significant? You know can it appear in the map at a particular scale? That is the question? If this little variation here, which is highlighted, it if it will not appear in the map at this map scale there is no use of talking offsets over here. So this is, you know, basically a decision, which should take in the field.

So whenever you are working in the field and whatever we are talking here, we are not talking complete things. That is the beauty of the surveying. You know why I said like this? Because in the field when you are working the field conditions are always different. You have to innovate then and there in the field by observing the feature. Okay? What my feature is like, how is it varying, what is the scale of plot, what kind of accuracy is required? Now on the basis for this you take a decision. What kind of offsets should I take, what kind of accuracy should be maintained in taking the offset? So you take a decision about that. So this is how we take the offsets. Okay. Besides this we will see one more principle of surveying, which we should follow here and that is about, if you remember the check, always we should have some provision for a check in our survey. Now how we are going to establish the provision of check in the present survey, in the present mapping? Well looking at the ground if you, look at the ground, the ground was looking like this and we have made a map of the ground. Map is a representation on a sheet. Now how to check the accuracy of this map? So in order to do that we make some provisions.

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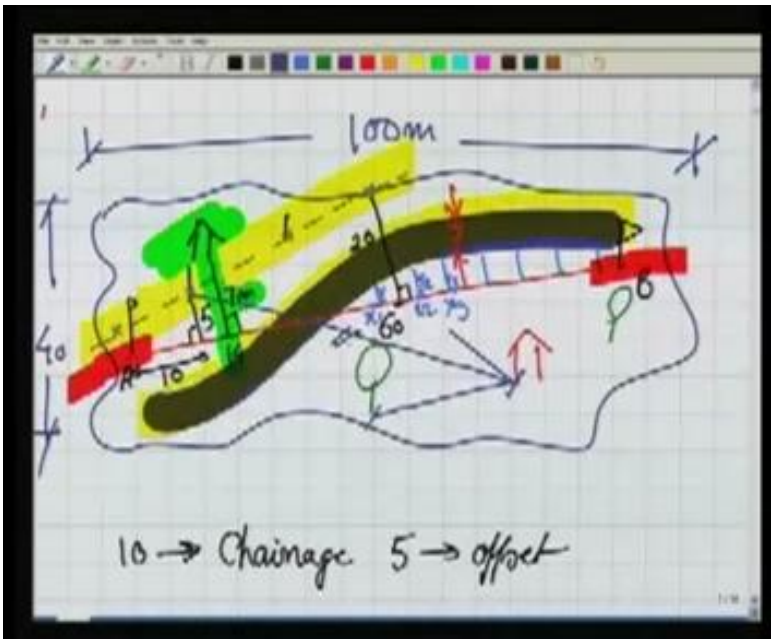

For example, there in the ground I take some observations which are independent of the survey, which we are not using in the survey, which you are not using in the plotting. For example what I can do, I can also measure the distance between this tree and the building here. I can measure the distance between the telephone pole and a building here. Well these two distances are measured independently there on the ground.

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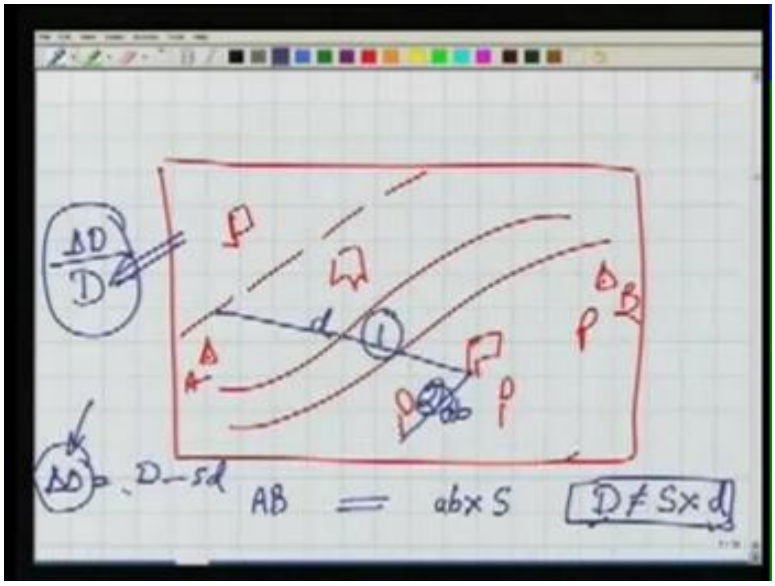

Then I go to the map. Here in the map we have the building, we have the tree. I can measure the distance also on the map. So we have a distance AB let us say I write it as AB measured on the map we have the same distance let us say I am writing it as AB don't confuse with this capital AB it is distance between those two objects in the ground I multiply this small AB with the scale ideally these two should be same. A distance measured in field should be same as the scale multiplied by the distance measured between corresponding points on the map. Similarly because I had measured the distance between this house and a telephone pole here, let us say d and the capital D. So capita D was the distance in the ground. This small d is the distance here in the map, so ideally this should be shown but obviously there might be some error and it will not be equal. If they are not equal then we see what is the difference delta D is. Let us say D divided by D minus d and then this difference in these two measurements is an indication of the error in the map and there can be various ways by which this error can be represented.

A very simple method could be you write this delta D by capital D in terms of the relative error and you can say well, my map has got this kind of relative error; I have shown. Here we took two distances number one and number two. For the checking in a large map We take many distances. Hundred distances, thirty distances in order to find the accuracy of the map. So this is very important whenever we make a map, whenever we do the survey we should have a provision to find its accuracy, to check whether the map has been made as per the accuracy or not because you take a decision based on this relative accuracy you take a decision whether this map is acceptable or not. Well next we will go to another discussion, which is very important and is related with the map making and we say that because in the case of the map making you will remember very often we were doing.

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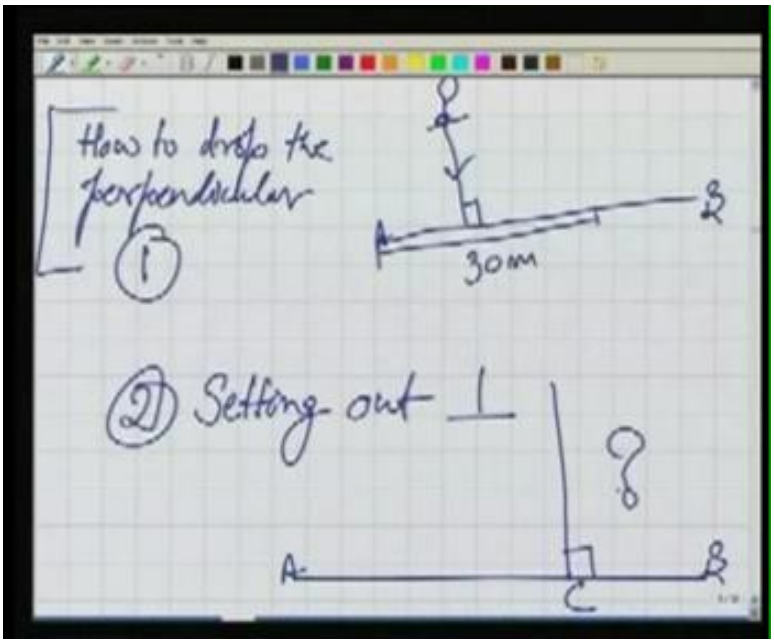

We had a chain line, which you are writing as AB any object, which we need to plot for example a tree we want to drop a perpendicular here and the question is how to drop the perpendicular this is important because we want to measure this perpendicular we want to determine this. Now if we will think of that ground think of, you know, the garden in which we are working last time or in your neighborhood anywhere just outside the out in your room where you are seeing this video lecture. If you have spread this chain along about two points and you want to plot a third point which may be anything a tree corner of the house or a pole you want to drop the perpendicular what will you do? There on the ground the chain is spread here. Okay, a certain length of chain is spread here. You are standing here at this tree and you want to drop the perpendicular you want to measure it how will you do that so we need to find some methods and methods means those, which we can apply in the field. The feasible methods, the practical methods, we need to locate those methods. We need to know about these methods then only we can drop these perpendiculars. So this is problem number one: dropping perpendiculars.

Problem number two is setting out perpendicular; setting out perpendicular means if you have a chain line at this point, you want to set out a perpendicular, you want to drop or make a perpendicular at this point at a given point. This is A and B, at C you want to set

out a perpendicular so how to do this? Now what we will do is try to see some instruments first, which will help us in doing this.

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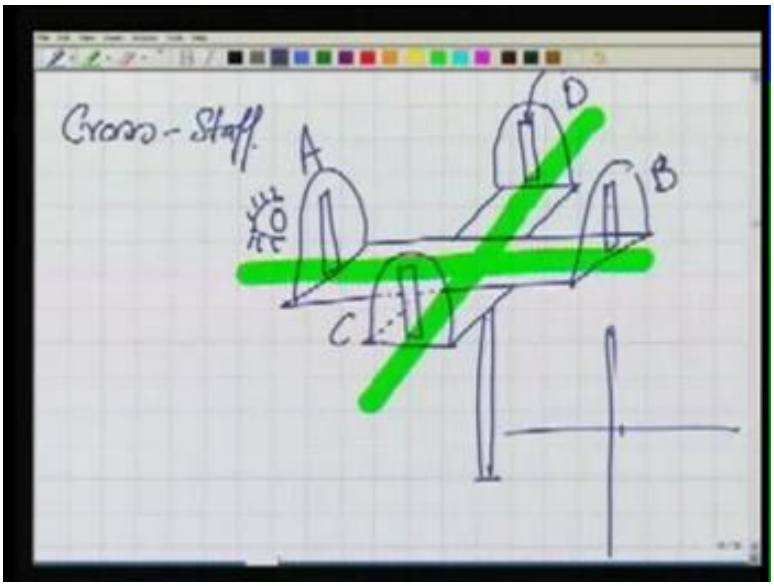

So instrument number one is here and this is called cross-staff. As you can see in this, instrument is a very simple instrument. There are two wings one you can see here, I will highlight this. Okay? One goes like this and the other one is like this and these two offset at ninety degree angles to each other. It is something like this. If I show you by hand this is wing number one, wing number two at ninety degrees to each other and then these two have got some, you know, wings. Here so this is standing and over there, we have a little slit. So over here we have a little slit. This slit is shown in the diagram here. So this is the slit and the corresponding slit here. So if you can visualize this instrument, is a very simple instrument. You can make if you visualize this instrument and I am standing at any point with this instrument. I am looking through one slit. Let us say I give the slits name, this slit A, slit B, C and D. I am looking through slit A so through slit A, I am looking trough the slit at B. So what, my line of site is now AB. Now if a second person looks through slit C and slit D his line of site is CD. So the line of sites CD and AB will obviously intersect at ninety degrees. This is how the instrument is made. Now how do you make use of this?

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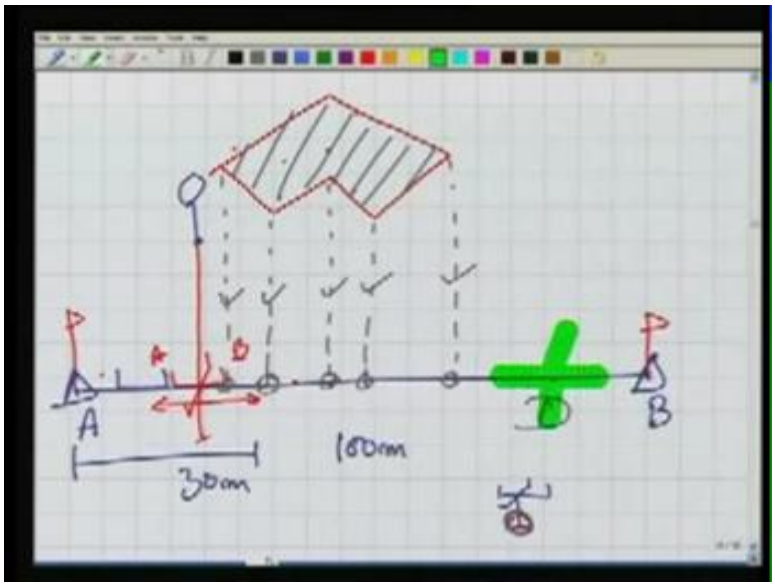

If you have so we have a line and the line is A and B A and B are the survey stations and B have let us say a chain spread along this line off course this line is let us say hundred meter approximately so chain will be smaller than that thirty meters . So chain is spread in thirty meters. Now using the cross staff the instrument we want to set out of first let us say we want to drop a perpendicular here is a tree we want to drop a perpendicular from this tree on this line. How should we do? How should we go about now? Think of the cross staff it is an instrument like this. We can see along two lines which are at ninety degree angle now in order to do this We will walk along this line using the cross staff and showing now the cross staff as a width is small instrument here in respect to this line so here is the cross staff I am moving along this A and B and this A and B they are marked by two ranging rods because in the survey stations we have put two ranging rods.

Now we are moving along this and as well as we are seeing through this, so while we are seeing through this we can ensure that we are moving along this. Somewhere here, when we are somewhere here for example, let us say somewhere here we can ensure that we are whether in line AB or not because we can see through this. We can see through this and it could be ensured whether the base of the cross staff is on the line AB or not. So once you have ensured it now we can move slowly along this line and as well as we will see through if our AB are along the slit A and slit B if they are along line AB over here in

order to ensure the perpendicular we need to see through C and D. So by a trial and error method you are moving along this line AB and seeing through C and D.You ensure that this object is visible once this object is visible clearly through CD then your base of the cross staff is on line AB.

So this is how you know you can establish several points on the chain line, which are the perpendicular from various objects. If there is a building for example, here in order to plot this kind of building you need to drop perpendiculars from various corners. All these perpendiculars you need to drop on the line you need to find their length. You will move along the line AB keep finding these points one two three four five once you have located the base of the perpendicular the foot of the perpendicular from these points you will measure these offsets by measuring these offsets these entire building can be plotted. The another job this was dropping a perpendicular. The another job, which can be done by the cross staff is erecting a perpendicular. For example let us say, there is a point here D and you want to direct a perpendicular from D. What will you do? Again as the similar way you are moving along this line AB the base of your instrument base of a staff. You keep at D, you keep the base at D. Once you have capital D then you are looking through A to B ensuring that your cross staff is align in such way that you are looking through A and B it is aligned along line AB.

Once it is so you move across now see through C and D so in your cross staff once it is aligned now you are seeing through C and D. So again you have setting out the perpendicular so is a very simple instrument. Nothing very special about it. You can set out the perpendicular that way at a point D. Now whatever is the length of the perpendicular required you will mark that length later on with the tape. Similarly this was one instrument which is cross staff you can make it as very simple instrument another instrument is optical square

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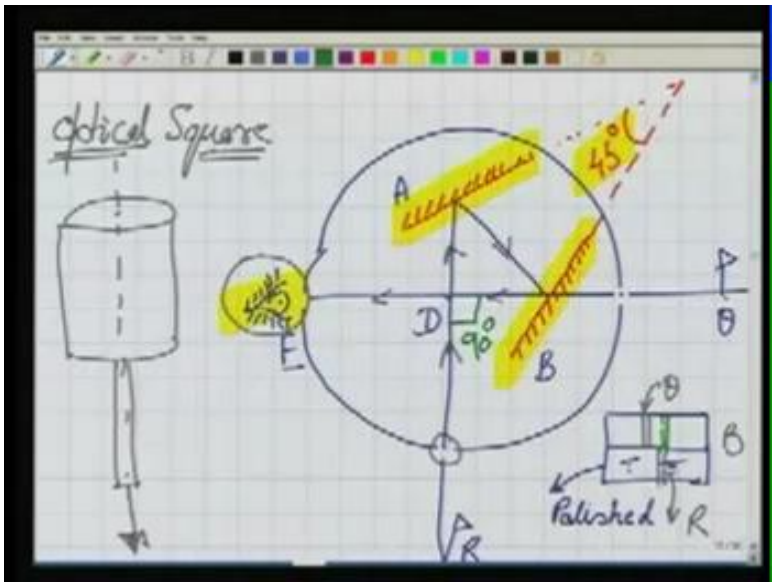

Now what this instrument looks like this instrument is nothing but a cylinder kind of thing, is a cylinder okay, may be made of brass and it has couple of slits and inside the cylinder they are two mirrors fitted at forty-five degree angle. Now if you draw the line diagram of this so it is a cylinder and it is fitted with again may be a little base and we can suspend a plumb bob. Also from here in order to see where is the center of this optical square there on the ground because I can hold it like this and wherever the plumb bob is mark in the ground that's the point where is the center of the optical square. Now what this instrument is the semantic of this inside? Inside this instrument as you can see here we have two mirrors, mirror A and mirror B. Now these two mirrors are fitted in such a way that they are at forty five degrees angle.

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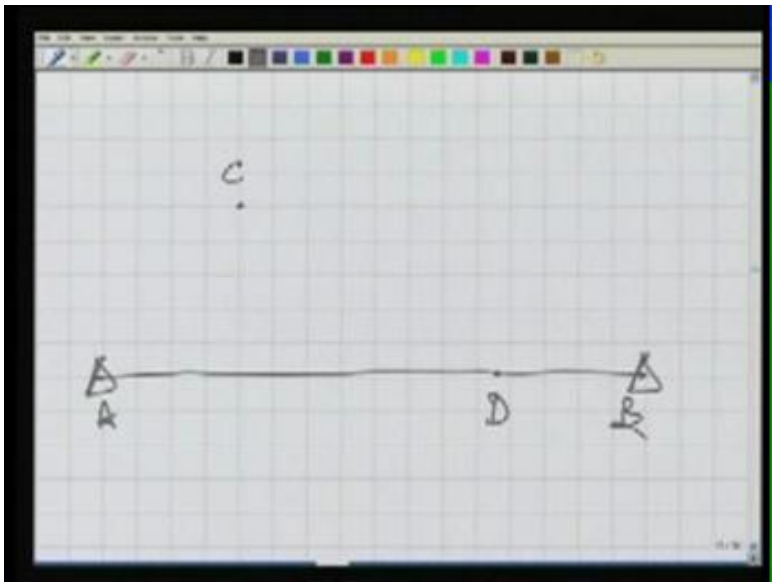

Well again the problem is same here also. We have a line marked by two stations A and B. The job is same, I want to drop a perpendicular from a point see on this line AB second time I want to erect a perpendicular at D in line AB. So it is you know dropping perpendicular and erecting perpendicular we want to do it using the optical square now how to do this here. Now in the case of the optical square regarding these two mirrors let us say the mirror at B I am showing the mirror at B here in this diagram this mirror at B is made in such a way if I show you here if this is the mirror B half of it it's polished polished means half of it is mirror and half of it is transparent. Just keep in mind this is polished this is the mirror part and this is transparent part. Now if it is so your eye is at E that's your eye you are looking through E and if you look through E what you will see you? Will see a ranging rod which is Q. So this ranging rod will be seen in this mirror somewhat like this. So this is my ranging rod Q also if there is another ranging rod at ninety degrees from this line EQ at R what will happen the rays from this R they travel trough this slit far and reflect from this mirror A. So they travel like this they reflect and again they reflect from the bottom part, which is the mirror polished part so it is reflecting from the bottom part and then they go to my eyes again. So here in this mirror when when I am seeing through this E what I see? I see Q and as well as another image.

So here in this mirror in this polished part what I am seeing? I am seeing the image of R. Now with this line diagram it is very clear if this point D is the point at the intersection of these two perpendiculars DQ and DR then in that case these two Q and R should form one line. Then Q and R should be like this. They should form one line, they will become one. So the procedure of working with this is the line diagram should be clear to you. We move with the optical square and you move till you see these two images. One is the direct image of Q which is coming from the task front part. The bottom image is the one, which is the reflected image of R and these two images will be slightly moving like this. Once these two images come together so at that point this center of the optical square on the line EQ is in such a way that this DQ and DR they form ninety degrees angle. So this principle is very clear you do not have this optical square or cross staff with you. You can make them easily of course. They are not very costly instrument, they are very cheap but it still there might be situation when these instruments are not with you so what will you do? In that case a simple thing.

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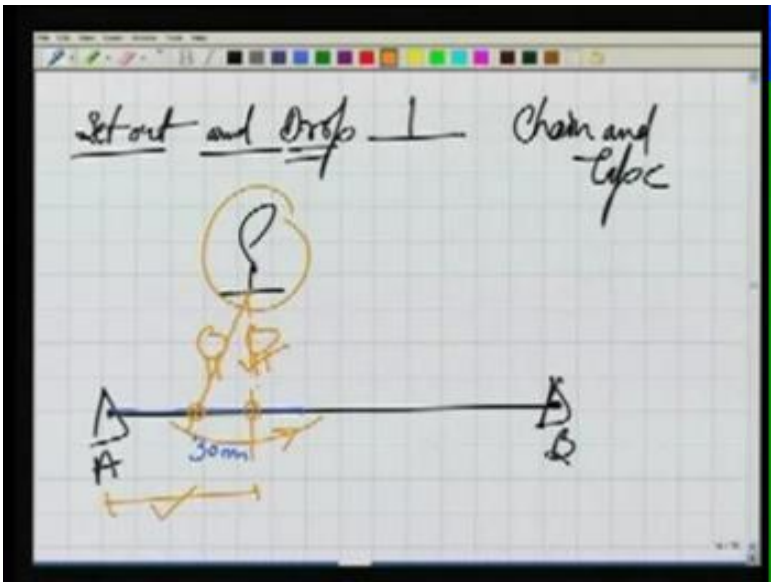

That's our chain line. A tree is here. You want to plot this tree, so you want to drop a perpendicular from this tree on my survey line, which is AB. What will you do? On this survey line let us say, my chain is spread. Okay? This is thirty meter length chain is

spread. What do I do? I take my tape now, I keep one hand of the tape here. I stretch it and swing it so while you are swinging the tape is basically, you are swinging the tape like this you look for the reading here the reading when the reading on the tape is minimum obviously that's the foot of the perpendicular. So that way once this reading is the offset value and the corresponding reading here is the chainage for this particular offset. So this is very simple method but always not always it is possible that you can swing your tape for example let us say there are some trees here. Can you swing that tape? You cannot because there are some obstructions. You cannot swing that tape. If that is the case then how to drop the perpendicular? This is basically dropping the perpendicular. So, another method for dropping the perpendicular could be:

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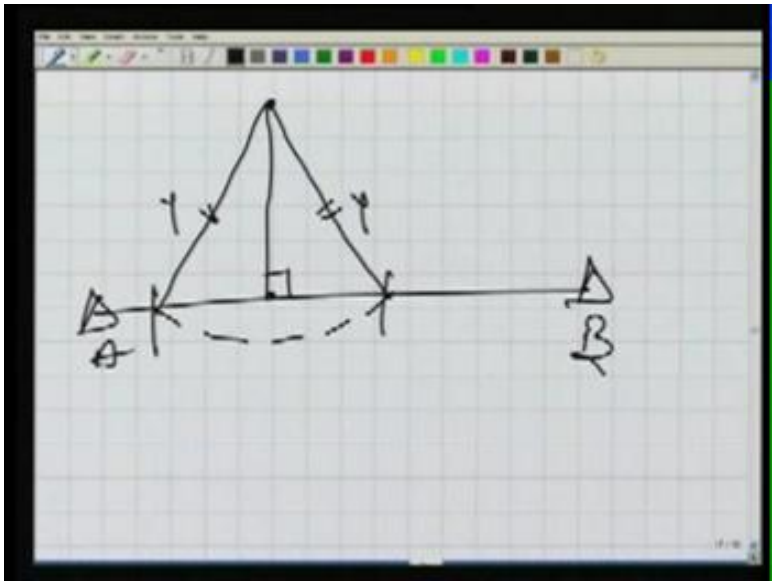

We have A and B. You want to drop a perpendicular from here. A method could be, you measure a distance let us say Y. You can swing your tape and you measure the same distance Y here. Whatever we want to do it you are measuring equal distances on both the sides. Once you have located these two points on the tape along the chain here you can find the middle point. So middle point will be the foot of the perpendicular. Similarly there could be one more method.

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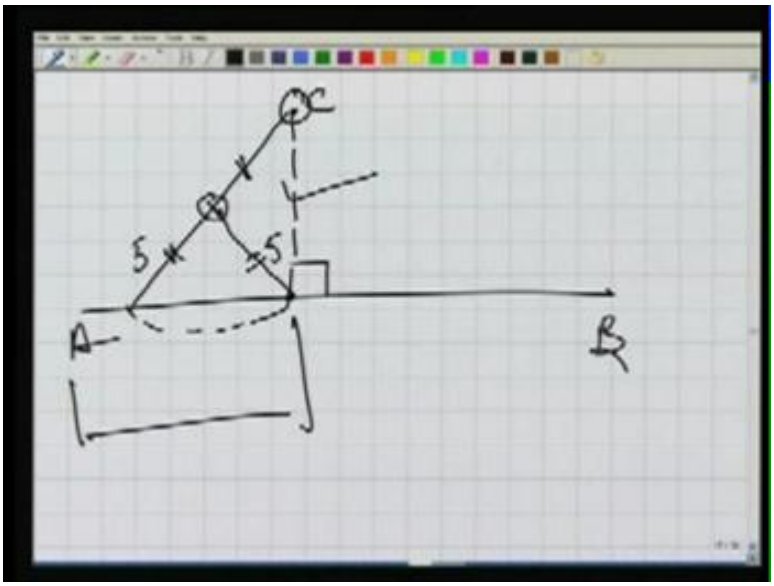

The point, which you want to plot C; A and B are the survey lines. Well what we do in order to drop a perpendicular from C on this line? Take any distance as is convenient to you, find the middle point. So these two are equal. Now from this middle point here whatever is this value, lets say five meter, take an arc of five meter here. Also so these two are at same distance well you know this length or this line will be perpendicular. So from this point a perpendicular has been dropped on line AB and we can measure this offset value whatever is the length of this and then chainage. So this is about dropping perpendiculars. Another thing, which is important is setting out.

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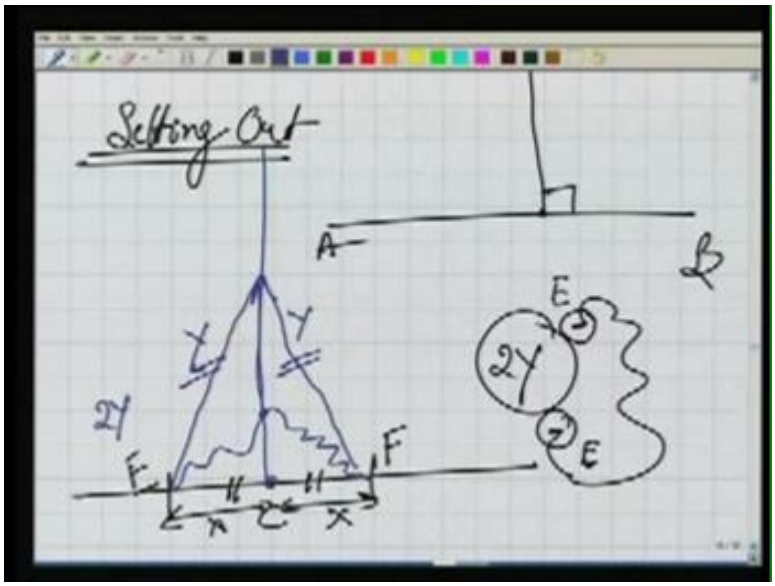

Setting out the perpendicular. Setting out means as we have set set only chain line is there or survey line and at any point we want to set out a perpendicular. Now how to do this? There could be many methods you know you can start with a simple method could be at this point C where you want to erect a perpendicular you take equal distances on both the sides let us say this is also X and this is also X once you have done it you a take a distance of two Y on your tape let us say that this is a tape and I keep the tape like this this is the distance of two Y the ends of a tape E end and F end I keep the E end of the tape here and the F end of the tape here and that's my tape here I am just showing it by a different colour and you know that length of the tape is now two Y. I hold the tape from its middle distance lets say at Y and then you stretch it. Once you stress this the tape will be stressed in such a way and we ensure we ensure that this, the pull or the tension in these two parts of the tape is same. Once it is so this will be also Y this will be also Y so from this point C. That's the perpendicular. There could be another method.

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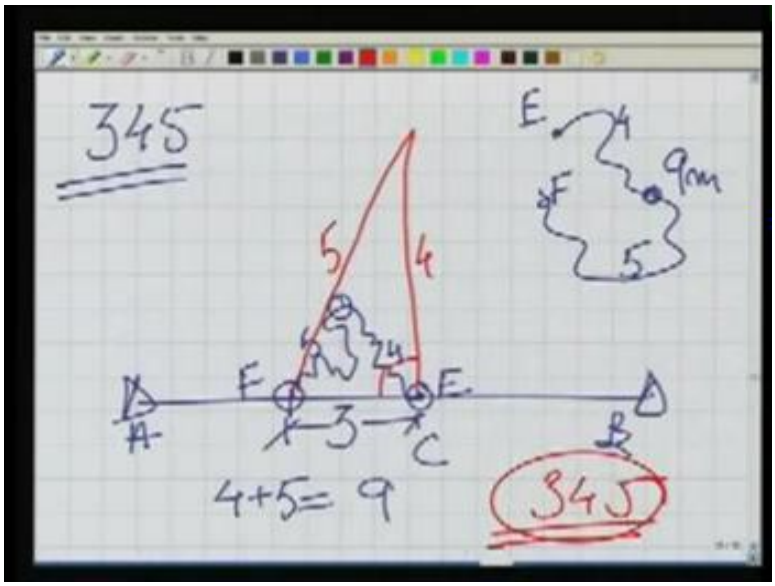

Three four five method. Again here chain line AB we have the survey stations. A point C in the case of three four five method. Let us say I take a distance of four meters or three meters here let us say it is three meters doesn't matter I take three meter then a distance of four plus five that is nine I take my tape and in my tape I take a distance of nine meters. Let us say if they are two ends again E and F. I keep the E end here and the F end of the tape here at this point and this point these two points are three meter apart. Then in my tape I hold it from a point which is five meter from F and four meter from E well after holding it here I pull my tape. The tape is initially cap like this and I am holding it here so that this distance is five meter and this distance is four meter. Once you pull it you pull your tape it will be pulled in such a way that if this is five this is four you know by Pythagoras that this should be ninety degrees angle.

So what we have done just by using the tape we have been able to erect a perpendicular at point C, not on the three four five but any set of these values which you should be aware. What kind of values, which will satisfy the Pythagoras theorem? Here you can make use of those values. So this was about perpendiculars there may be some other problems. These problems are marking parallel lines.

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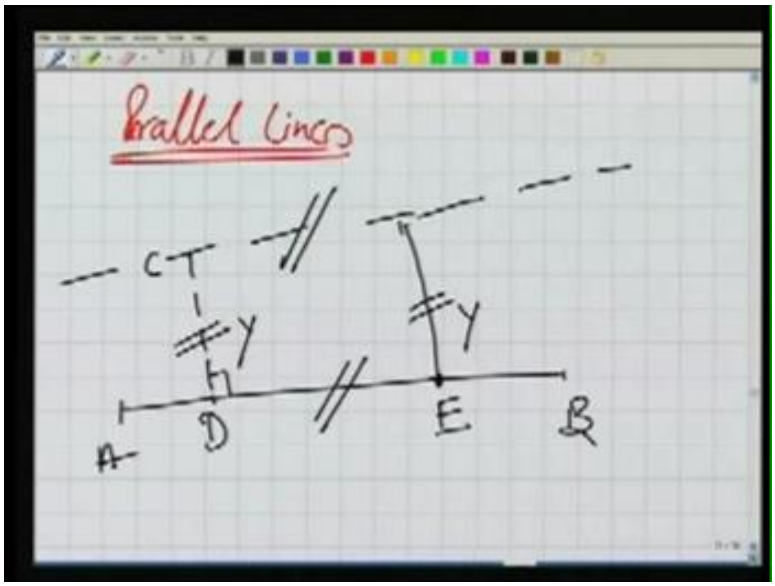

Parallel marking, the parallel lines. If there is a line AB, we want to set out a line parallel to this AB from a point C, how to do that? Well the method could be a very simple method. You drop perpendicular number one to measure it's distance from a point here. This is lets say D. You go to the point E. Again erect a perpendicular on this of the same length. If this length is Y keep it same as Y. Now joining these two points will ensure that this line is parallel to this line. There could be many other methods.

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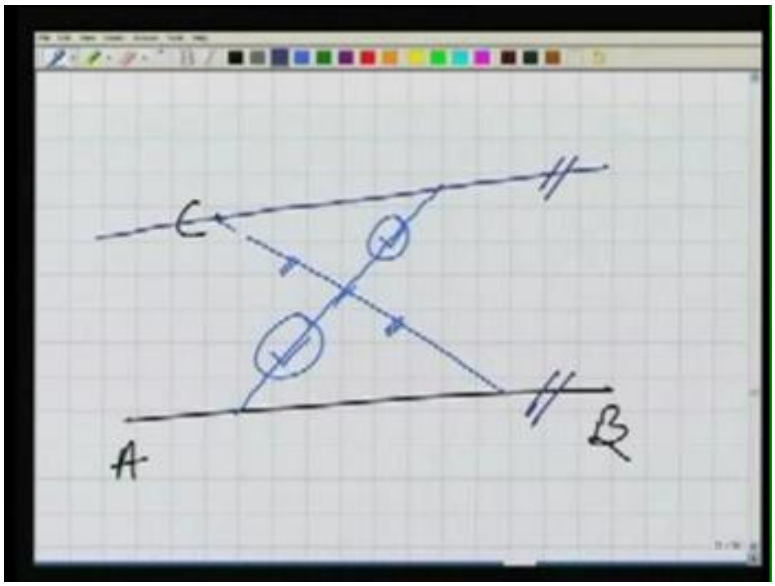

Now your line is AB. That is the point C. Take any line. If you cannot drop the perpendiculars, take any other line, for example let us say I am showing this construction by blue lines and line find it's middle point. So these two are equal. Now from this middle point join any point here now whatever is this amount extend this line by the same amount so these two are equal. This part and this part are equa.l if that is so then the line joining these two points will be parallel to our line AB. So there could be varieties of cases like this what I am showing you. I am showing you only a little glance and what you can observe you can observe that we are making use of our simple geometry. You know characteristics or principles what we know in your high school just looking use of those principles of simple geometry we are able to do some good jobs.

So what we saw today? We saw how to make a map using chain and tape and we followed all the principles, you know, what came from whole to part check, redundancy reconnaissance, all those things. We followed when we are doing that and in doing that we came to know that there we need to measure the offsets. We saw how to record these things in the field book, how to make a plot of those things then in drawing, the offsets we can drop, the offsets we can plot, the offsets by various methods this all depends upon the field conditions, what is there in the field so accordingly you have to find a solution.

There might be various problems in the field so you have to come out with the solutions for that particular problem what we saw we saw some of the examples of some problems. Thank you.