Farm Machinery
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Lecture -04
Tractor, Implement and Soil Force Consideration for Tillage Implement Design (Contd.)

Welcome students; as I explained in my previous class that we talk of the, about the other tillage equipments. Now, we will talk of those equipment like disc plough, cultivator etcetera.

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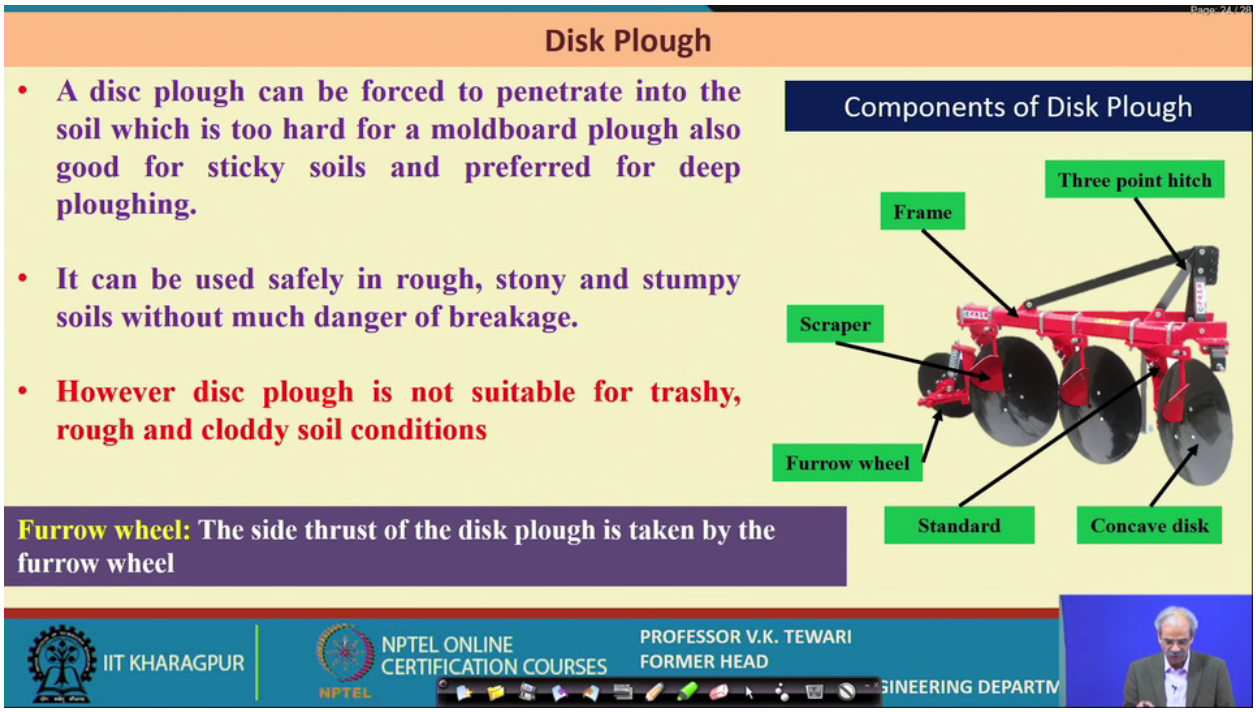

Well, disc plough well I have talked of the disc plough early in the field. Now, here we can see that the different items of, these are three points hitch which are connected and the frame, the scrapper, the furrow wheel and the standard which are connected to each one of the major ones and concave disc. It is a concave disc which has sharpening, very sharpening about chamfered, so that it cuts the soil.

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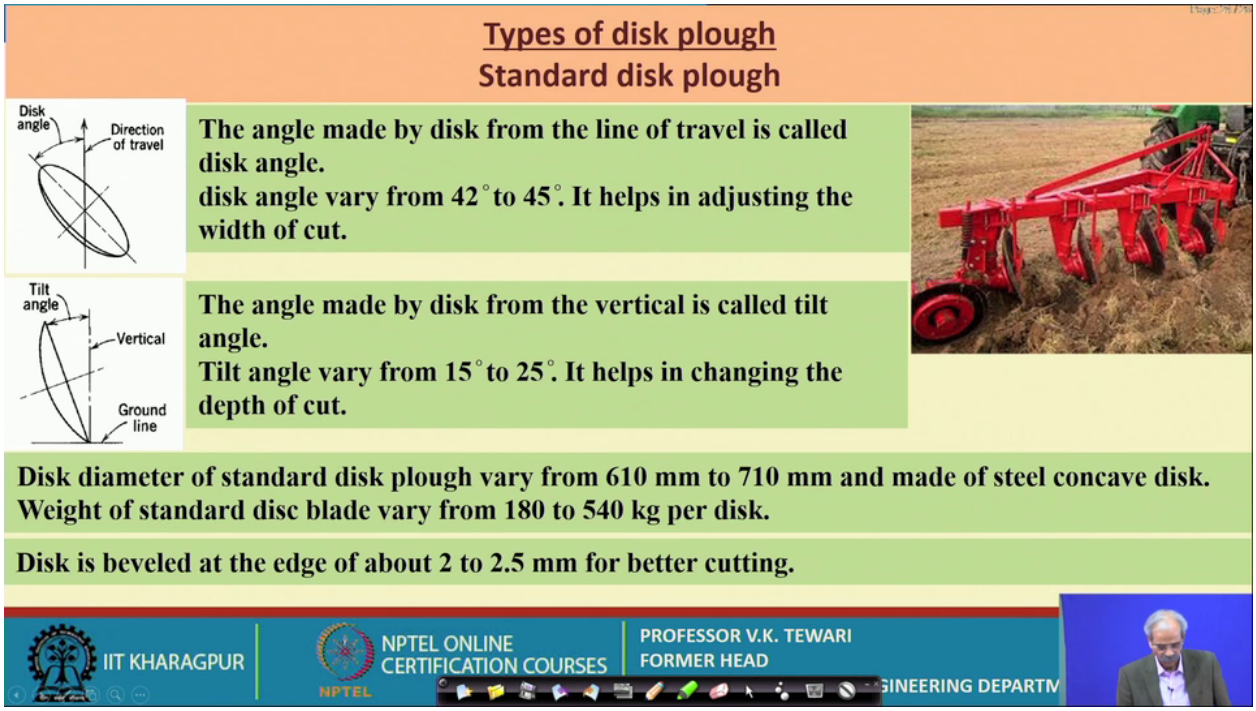

Now, types of discs; well I have already told in the field itself that the importance of the disc is in with respect to its line of motion is important, where you have the disc angle and the tilt angle. So, tilt angle which varies from 15 to 25 degree and the disc angle which varies from 42 to 45 degree, this helps in adjusting the width of cut and the tilt angle helps in adjusting the depth of curve.

And generally, these discs are made of steel and they are in the range of 610 to 710 millimeter in the diameter. These are concave disc and disc is beveled or the chamfering which is given about 2 to 2.5 millimeter for better cutting of the classes etcetera when it rolls while doing operation.

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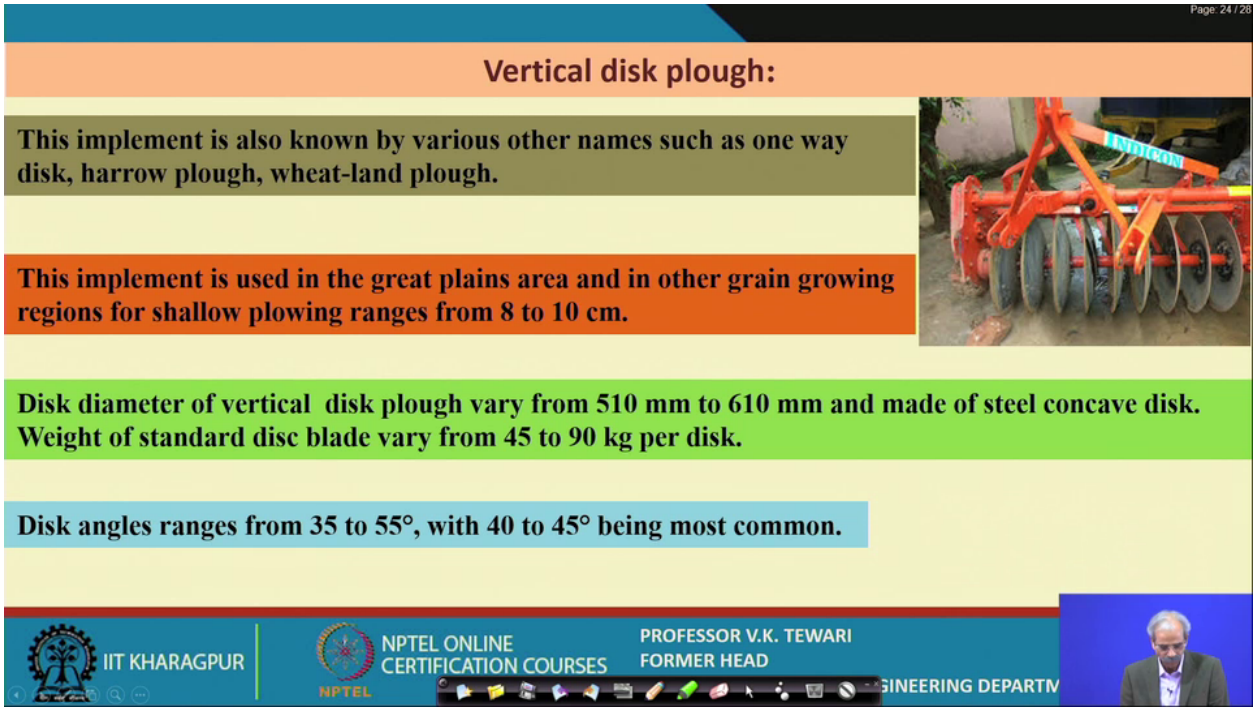

Vertical disc, in fact these are implements which are attached, but they are very much used here. In fact, use about harrows we talk about harrows and these are the implements which are used in very large equipment, but then we would like to show you that these are also there and they are being used with lager equipments in other parts of the world where several discs are there and they are connected at the angles which is the disc angle ranges between 35 to 55 degrees.

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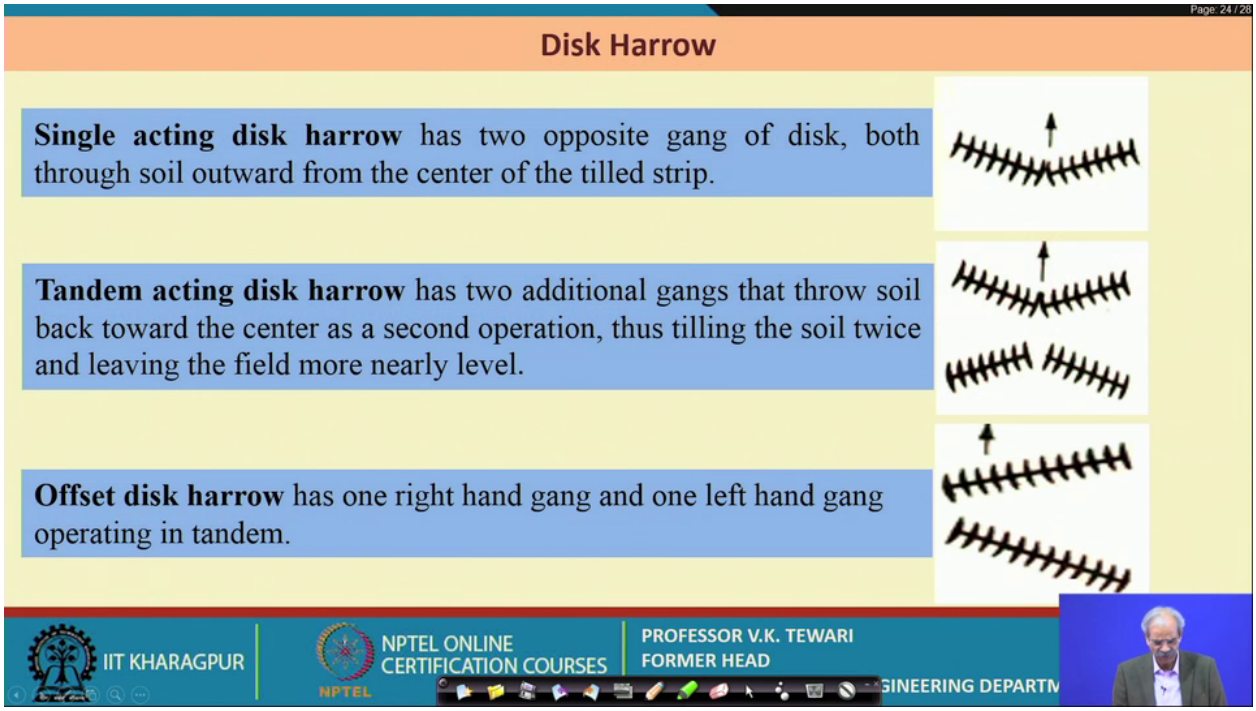

Disc harrow, well you have seen the operation of the offset disc harrow. Now, here are some of the disc harrows between which I want to show you single acting disc harrow. Here the soil is sown on one side and soil is sown on this side here, the soil is sown on this side, the soil on this side. Now, here the soil towards this and the soil is towards this here. So, then case of this you can see the soil is been sown here, the soil come bit of here and we have shown in the operation of these.

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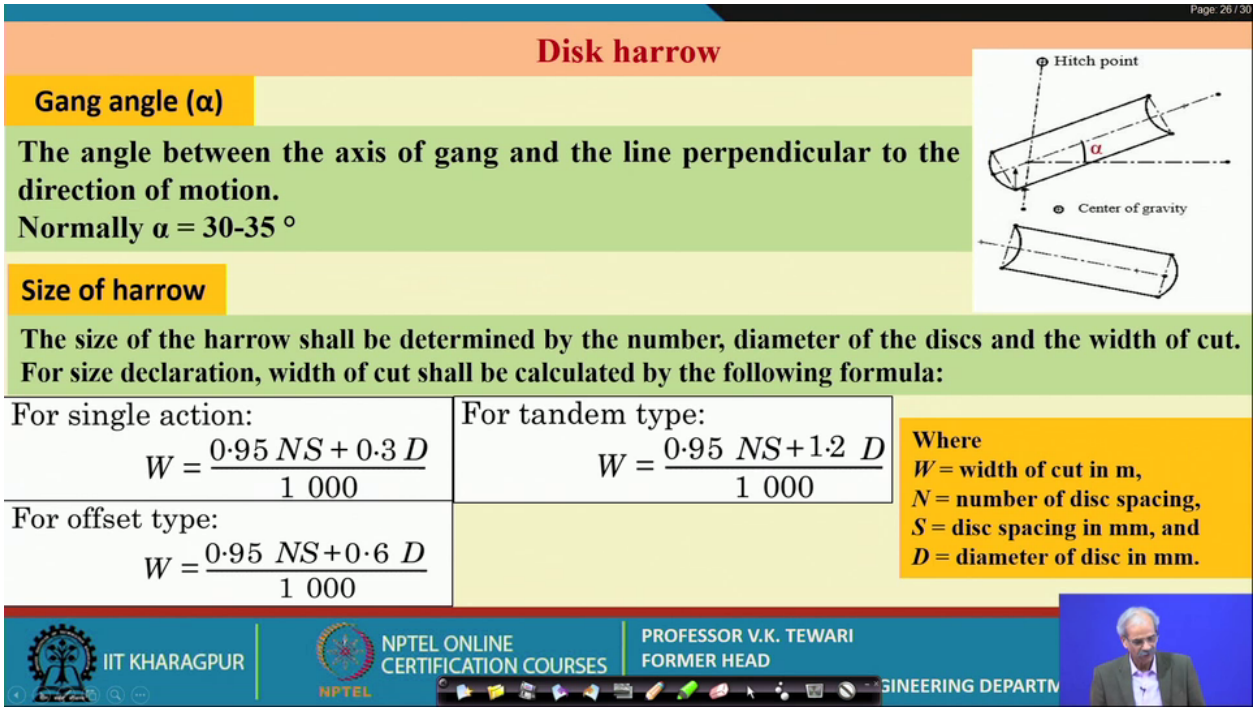

Now, how they are connected and what is the action we will see in later on. Well, disc gang angle as I told you earlier in case of offset disc which is of varying use. Many attempts of the disc has used in orchards, sometimes to clear grass as etcetera or to cultivate the land in between the crops, the horticulture crops or the trees which are there. So, it will have a look at this.

This is the angle which is the angle which is known as normally the gang. Angle which is over 30 to 35 degree which has seen the center of gravity of this particular implement is over here and this is the hitch point to the tractor.

Now, for single action, one the width of operation is given by this the offset. In case of the offset type, the width operation is given by this. In fact, it comes from the geometry of that; this has been calculated from the geometry of the whole implement and then, you should be in a position to use this whenever it is required for finding out the total force requirement.

For tandem type, the value is something like this where W is the width of curve, N is the number of disc spacing and S is the disc spacing in millimeter; D is the diameter of disc in millimeter. So, keeping in view these units and the formulae that we have found out, you can find out the total draft requirement.

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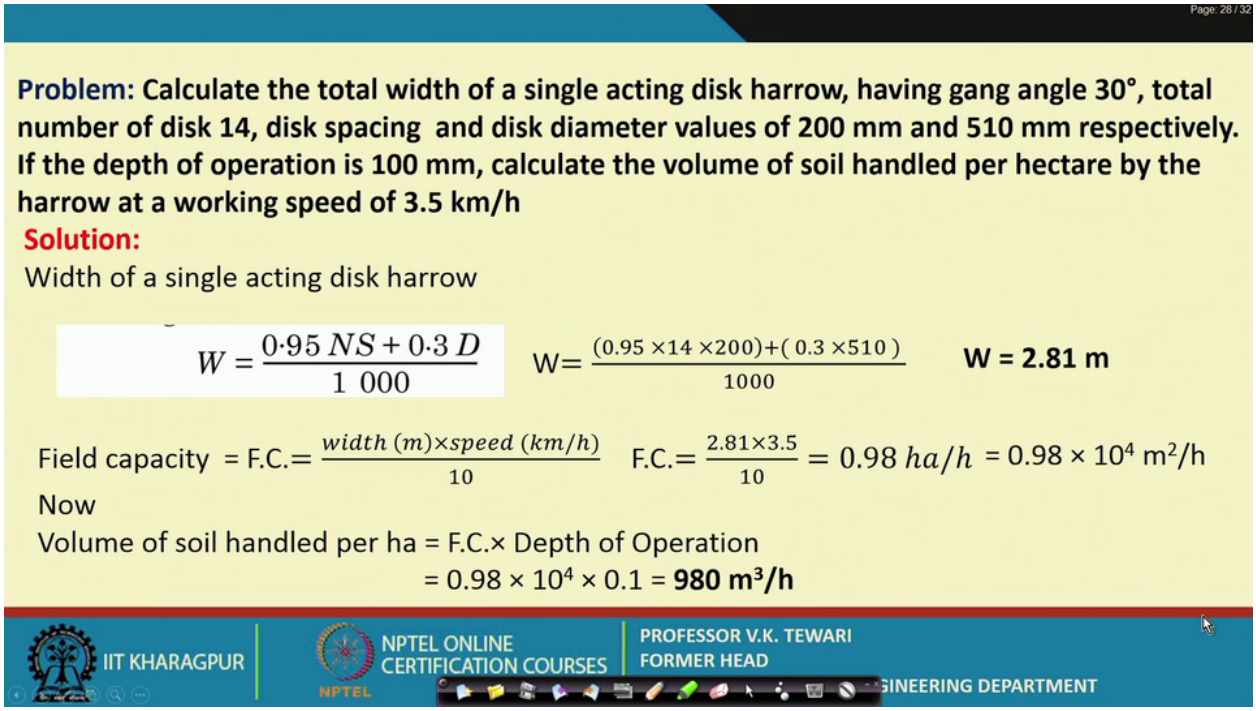

Yes and the problem is given on this particular offset disc harrow which is a single acting disc. Sorry, calculate the total width of the single acting disc harrow having gang angle 30 degree total number of disc, 14 disc spacing and disc diameter, now when you use this equipment. You have to always think of which particular formula to be used and what are the units? Because if you do not get the units right, definitely you are not going to get the correct answer for this.

So, if you use this width here, you can get the value about this much, then field capacity can be used with width and the speed of operation. So, field capacity works about in so much and if there is another portion which you see that calculate the volume of the soil handled per hectare by the harrow at a working depth of 3.5.

So, if this depth operation is known, then you can find out the total volume of soil handled which is about 900 meter and 80 meter cube per hour. So, accordingly you can find out that this is the width operation. Now, this is given only to understand; you can better understand [vocalized-noise] the implement and its accent how it actually feel and what are the forces which are acting according to power which can be generating or required for operation of these.

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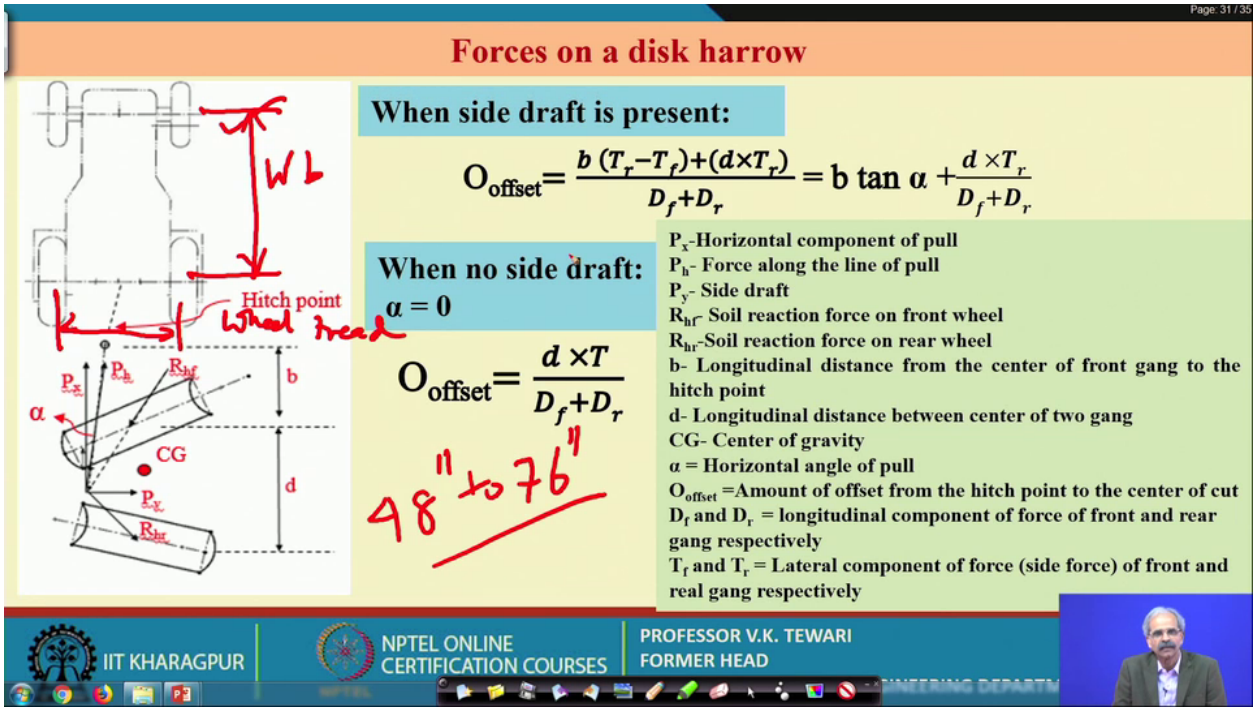

Forces on disc harrow, well offset disc harrow for offset disc harrow, this is important. We have also made here and I wanted to show you that when this is the tractor here and in this tractor, well one thing which I would like to show you is the we know that from here to here is the wheel base and these two this is known as the wheel tread; this is known as wheel tread.

Now, this distance keeps on varying and this vary from 48 inches to 76 inches. Although this is provide, this provision is there in all the tractors, but generally farmers are not doing it for the simple reason that they do not have the equipment which are to be used in different root way spacing of the crops. And so, this is not used, but then for the academic purpose, I think it is worth going about this part.

Well, so in the disc harrow here we can see that a pair of disc harrow is over here [noise] and we can see that the hitch point is. This is the hitch point through the tractor and this is one gang and this is another gang. It is offset, this is this point that which CG is there and some center of the first front gang, it is at a distance of b and the rear gang at distance of d. Now, the offset if this line is it is which is in this line, then the force acting is P h. Here P h is the force along the line of pull; now, P h is horizontal component of pull.

Now, this P x in case there is an angle alpha. That means, when there is no side draft, alpha is equal to 0, but when there is side draft, this P x comes into picture. So, when this side draft is not there, it is simply we can take this P h here and the offset, when side draft is present, this offset is like this and when side draft is not present, the offset is given by this particular equation; where T is talking of this T should be lateral component of the force side, side force about front and real gang in case of the torques of T f and T r, this should have been d.

Now, similarly d is the longitudinal distance between the center of two gangs. This is the distance b over here and D f and D r are the longitudinal component of force front and rear just talk of the front and rear now this T this in fact because when this alpha is 0 here, then it should be T r. So, it will be T r here which is the lateral component of the force on the rear gang, right.

So, this is the mechanics of the forces on the disc harrow. This is the mechanics of forces on disc harrow and it will be important that if we take up a problem on this and then, understand. Let us see if you can have [noise]. Yes.

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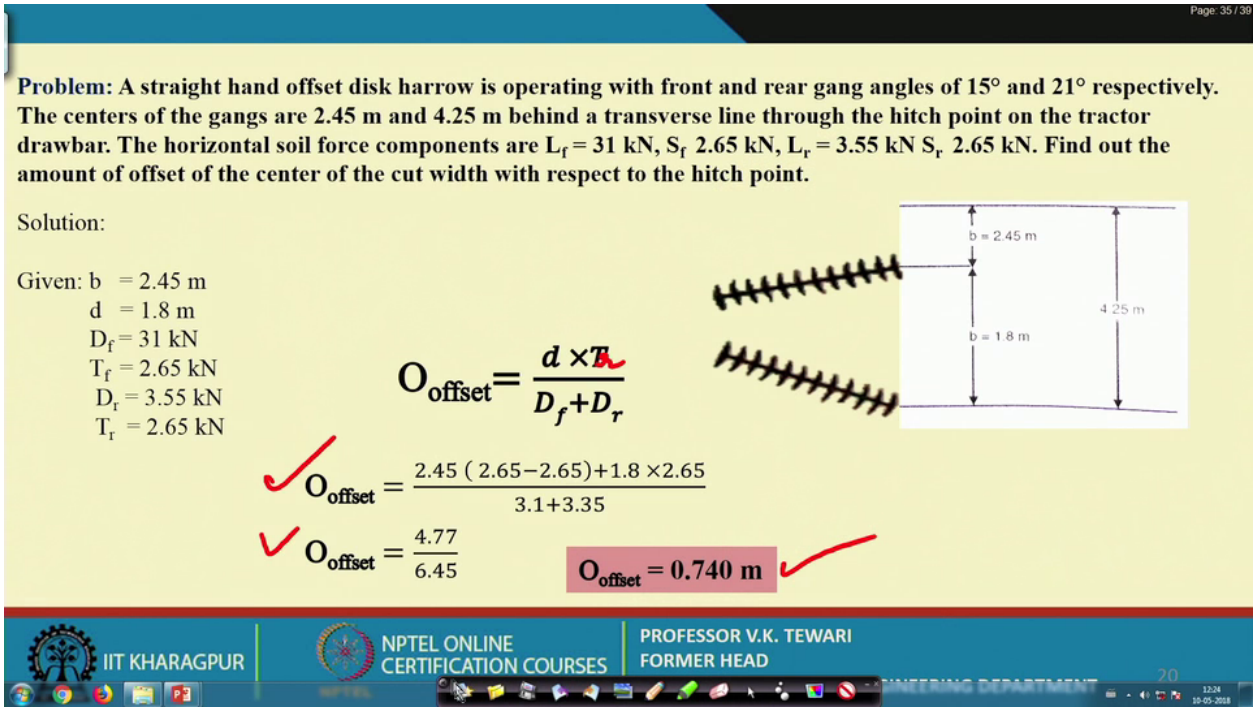

So, we can have a problem on that and here there is no angle. Alpha is not there which was discussed over there and here itself also [noise] this T r. So, we can use the equation

which was given earlier and we can find out the offset values; which is up to this. Now, these problem will help you to better understand what is an offset disc harrow.

Now, from the academic point of view as well as when you want to design for a particular power source or when you want to have a matching implement design for a particular power source or when you want to have a number of implements required for large area where certain power sources are already available and we want to get these to be connected or to be procured for better mechanization of that a particular farm, then these will be required. This information will be definitely required for you.

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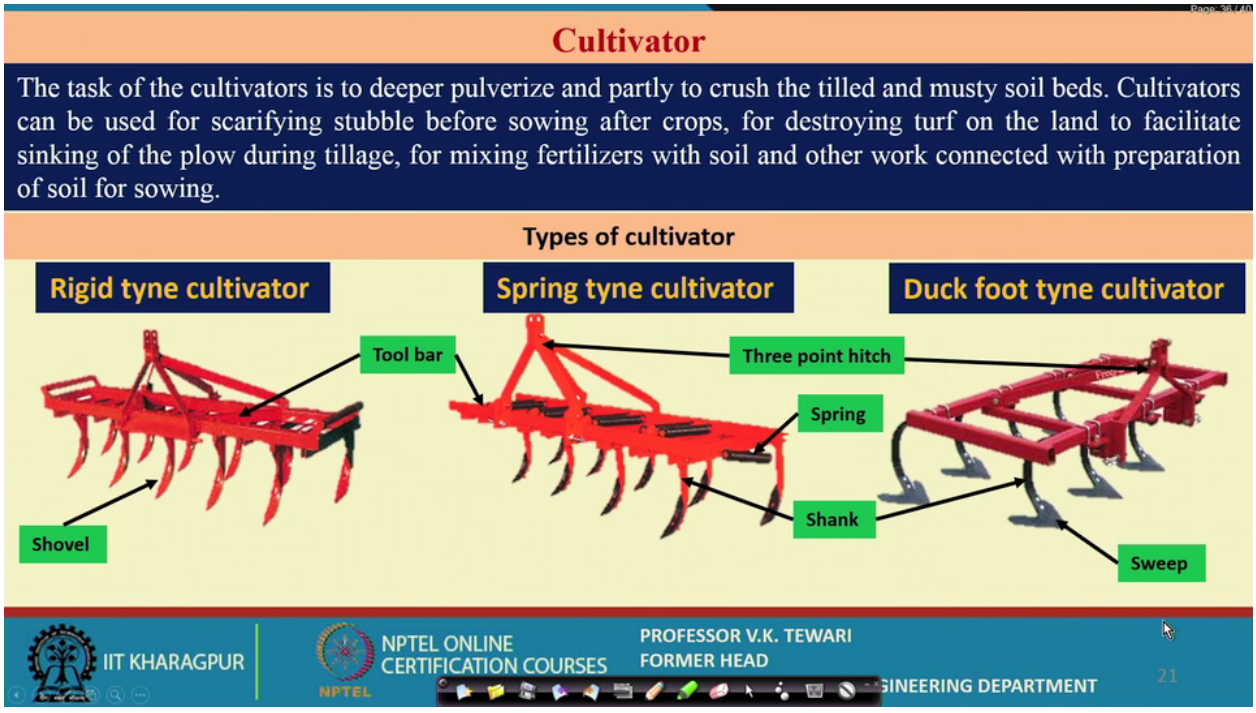

Well, cultivator now this is a secondary tillage implement. You have seen already the operation of this and in the field the shovels are here. In fact, [noise] and where these are the shovels which are there when the tool bar is spring tyne cultivator with these are the springs which are there [noise] and the rigid tyne. The rigid tyne which I had shown you in the case, yeah this is the rigid tyne and this is the spring tyne. Now, duck foot type of cultivator.

Now, here this is sweep type here and this is known as the shank on which these small shanks. No, these are small tools, cutting tools or shovels or cutting tools are attached. We will see what are the different types of these because different cultivators have been

used for different types of operations, but then many a times, this cultivator is used for a primary tillage implement. Now, we will have a look at those different types of these small elements, yes.

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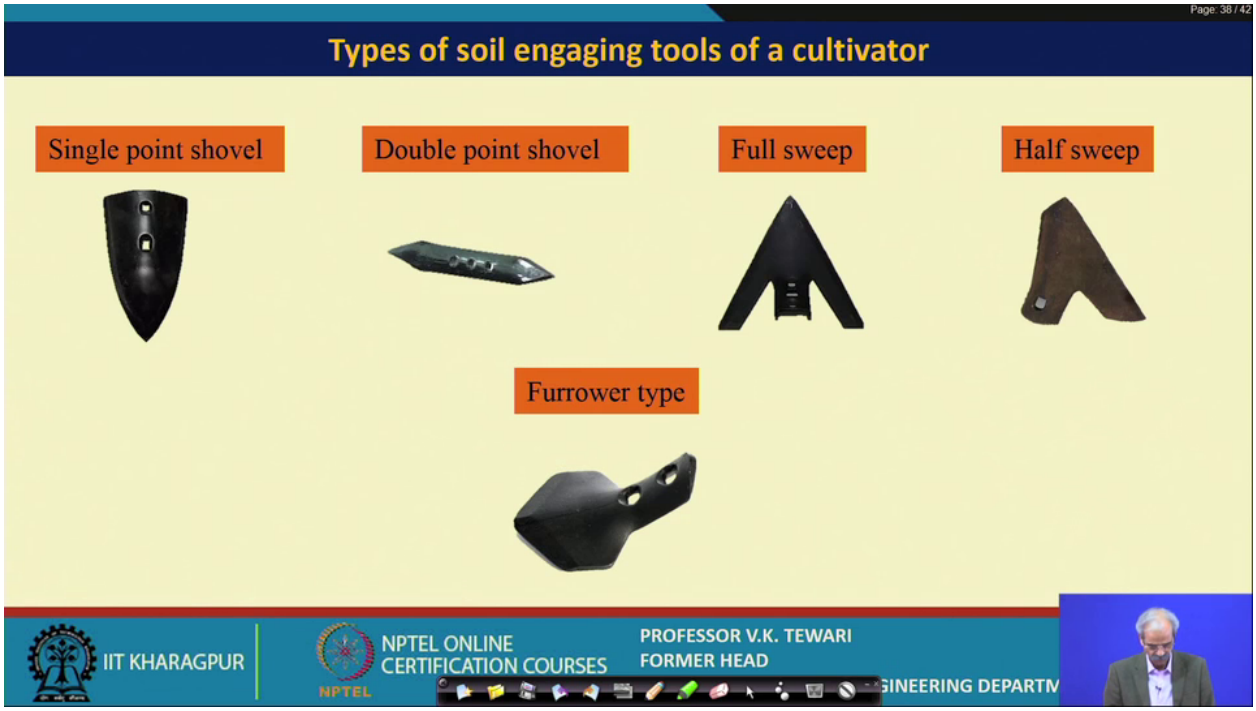

So, these are the different soil engaging tools of a [vocalized-noise] cultivator, this is half sweep, full sweep, double point shovel, then a single point shovel, the furrow type. So, these are the ones which are then only used on that depending upon the type of the requirement in the shanks of those tools.

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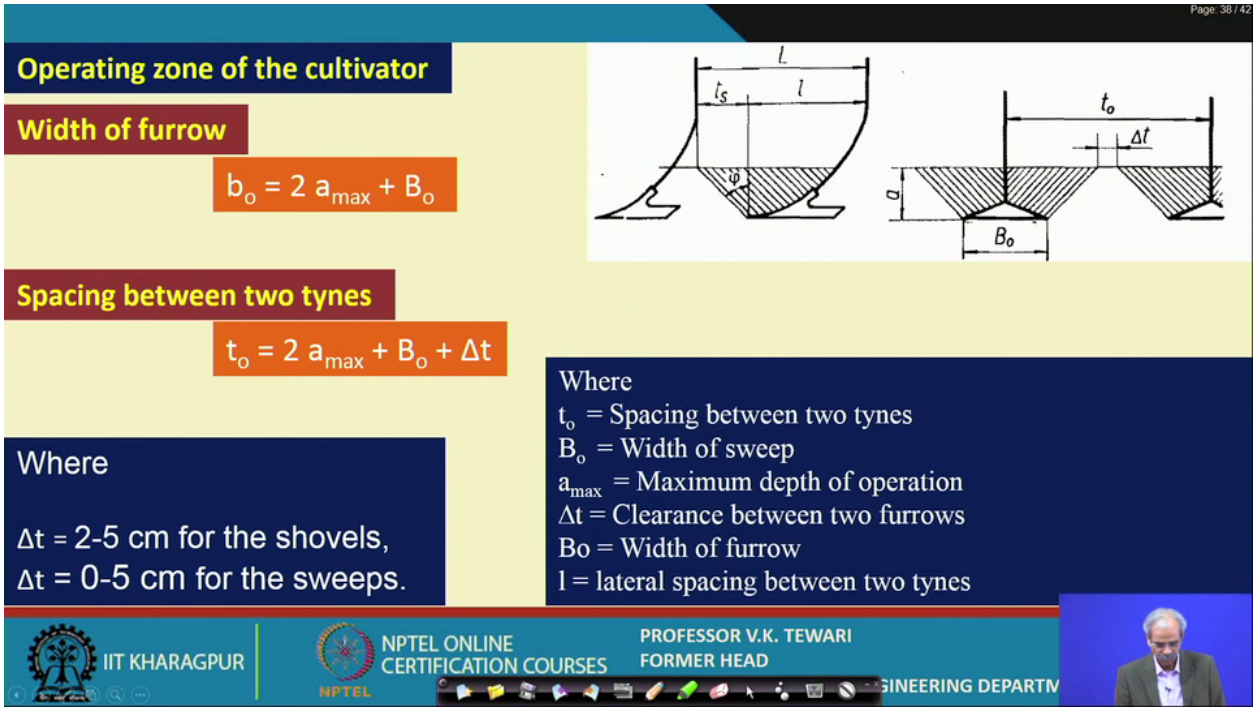

Well, when a particular type of element is used, what is the soil zone? What is [noise] yes [noise]. The soil operating zone of the cultivator you can see that this is the type [vocalized-noise]. What is the soil zone which will affect? So, you can see that the total soil zone if these are two consecutive tynes, so the total zone is the distance between this two, this t 0. This is the distance and this t 0 is given as t 0 is equal to twice a max plus b 0 plus delta t.

So, delta t is the distance, this 2 to 5 centimeter for the shovels and about 0 to 5 centimeter for the sweep type. Now, this will be important when you want to find out the total width of the implement with respect to this spacing between two tynes and the b 0 width of the sweep, a maximum depth operation. These are all details which were given over here. So, this will help you in finding out the total width of the implement when a cultivator with these total operating zone and it is connected with this small tynes [noise], yes.

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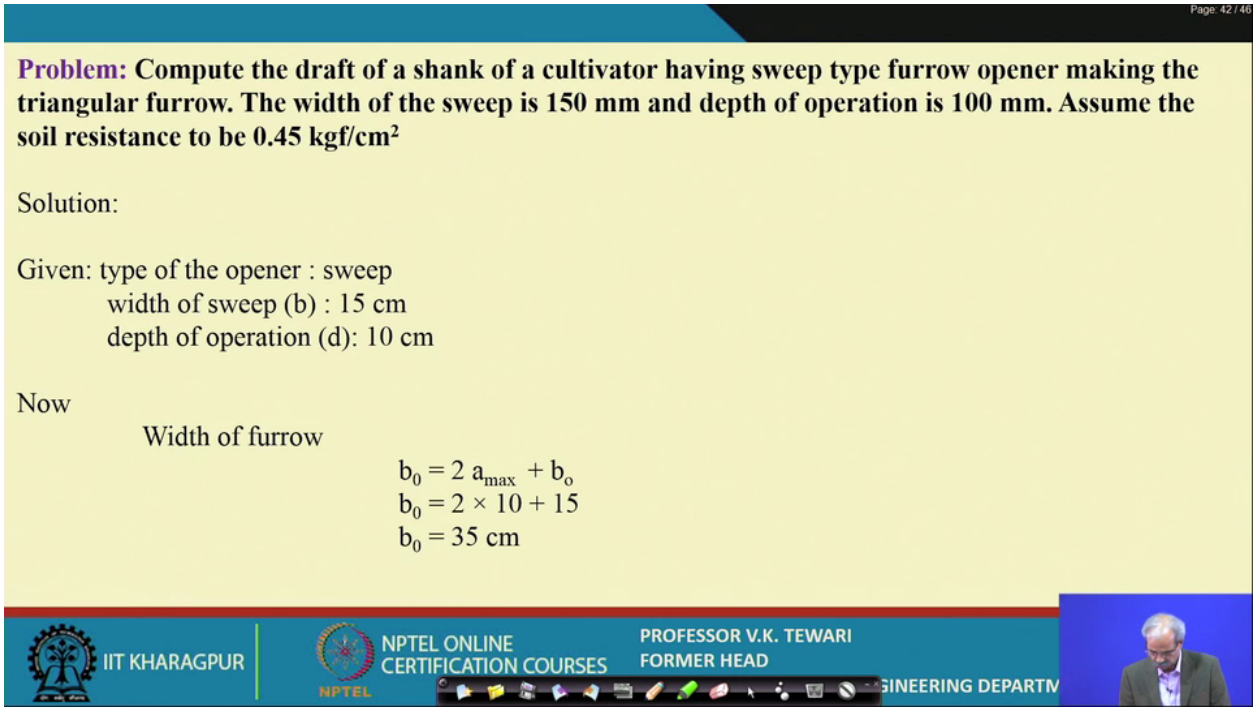

Another small problem is given which will help you to understand how we can find the total cultivator. So, [vocalized-noise] opening zone or you can find out the total width of that furrow which has been operated or which has been cut by small elements which are connected to the cultivator.

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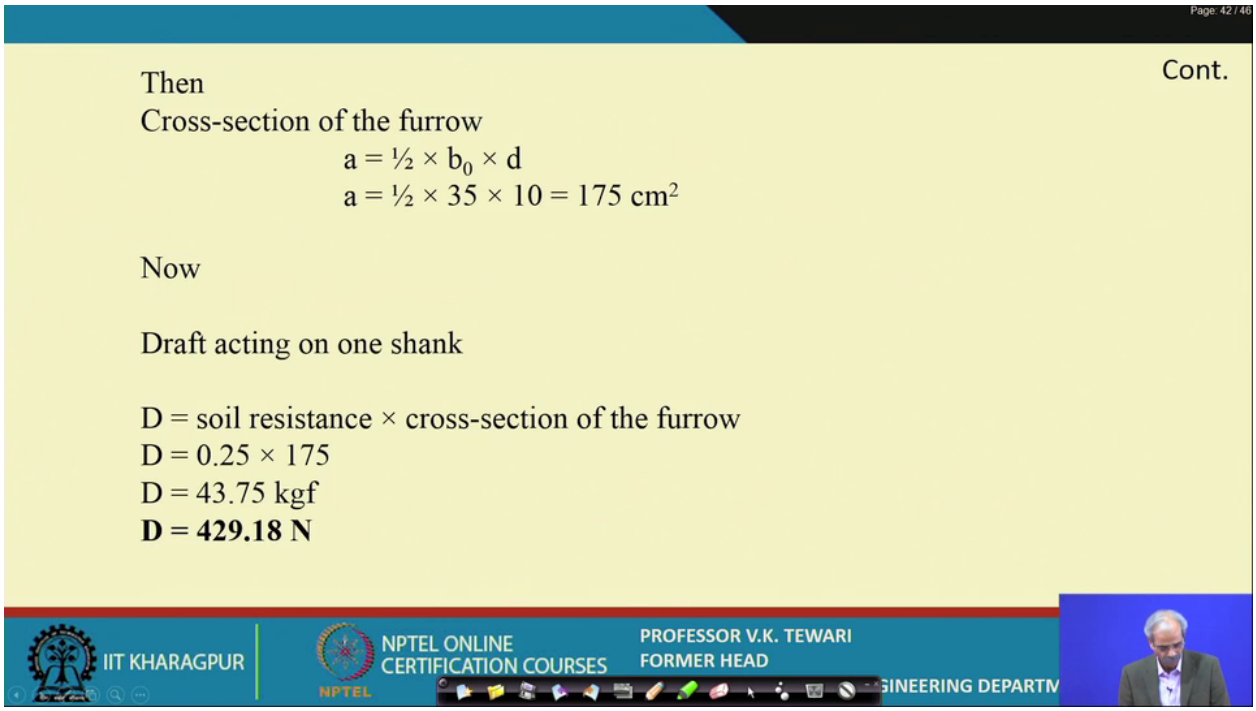

The details are given over here.

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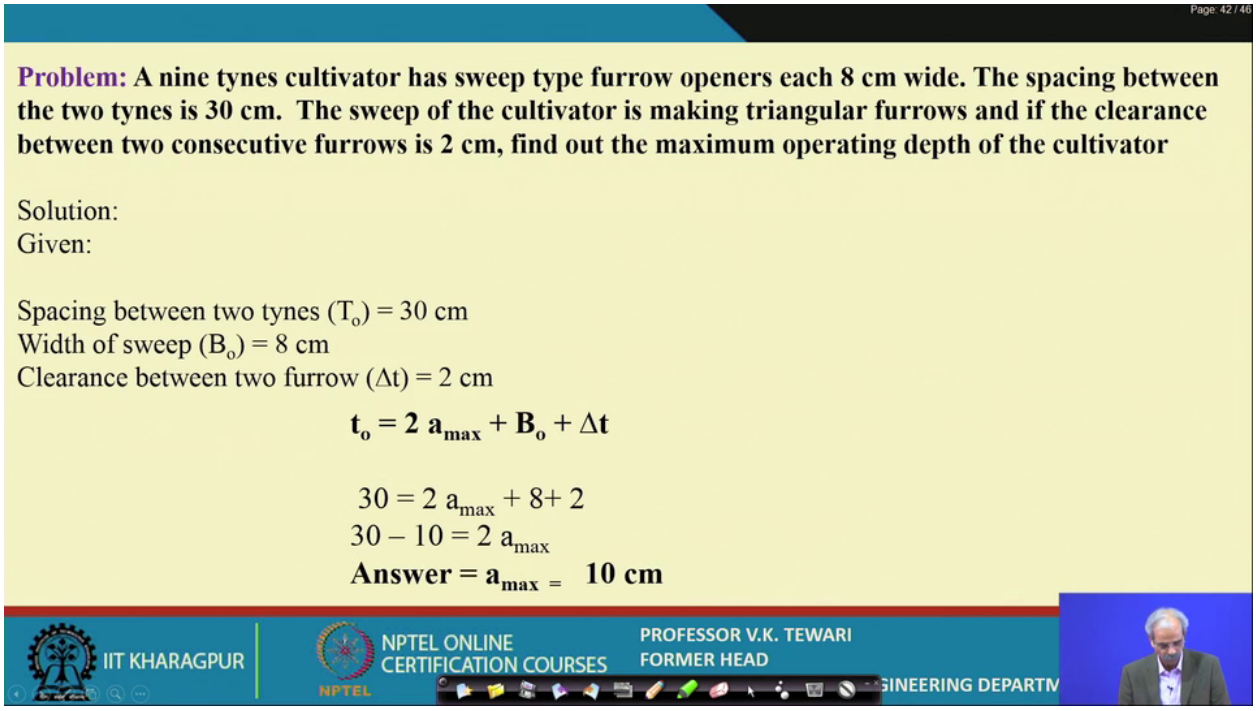

A nine tyne cultivator, well another problem which has the similar values which can be used and you can find out the, you can find out the t 0 over here and it is very simple problem. Once you go through this, you will be in a position to put those values and get the answer.

Thank you