Evaluation of Textile Materials
Prof Apurba Das
Department of Textile Technology
Indian Institute of Technology- Delhi

Module No.#01
Lecture No. # 04
Sampling Methods and Sampling Size (Contd.,)

Hello everyone so we will continue with the sampling of textile material. So last class we have discussed the broad classification of the sampling.

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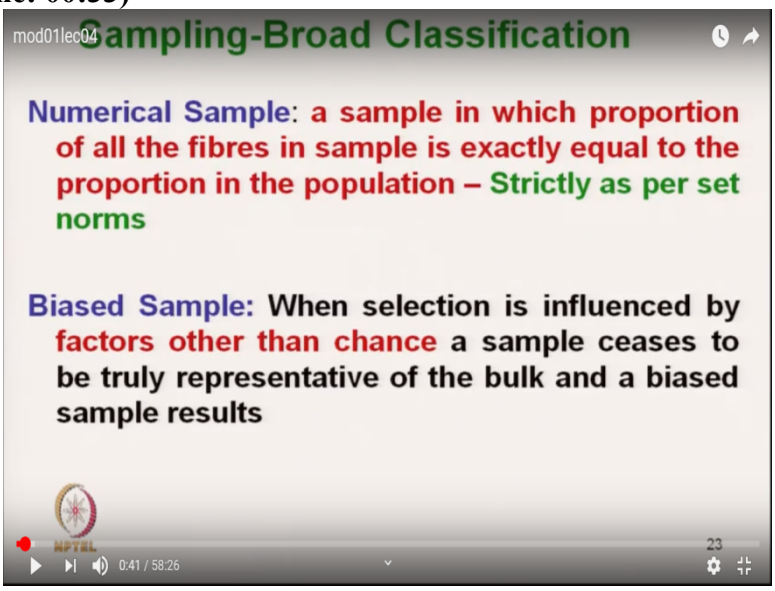

It is broadly classified into two categories. One is numerical Sampling and then another is biased sampling. Biased sampling is mainly, it is a length biased we will discuss.

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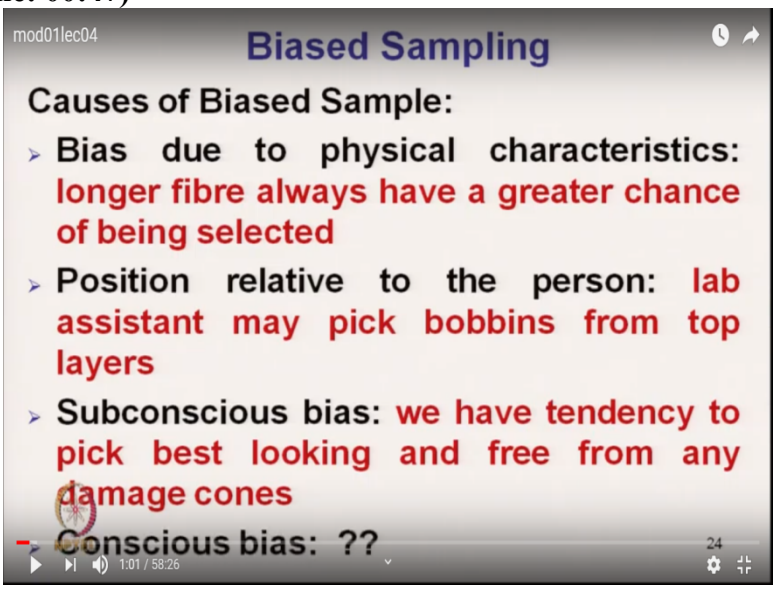

And causes of biasness we have discussed. It is due to physical characteristics of material, position of relative to the person, subconscious biasness and conscious biasness this we have to discuss. Now we will start with the terms, various terms related to the sampling. So

commonly used in the industry okay. The terms first term is consignment one must understand this difference between these terms.

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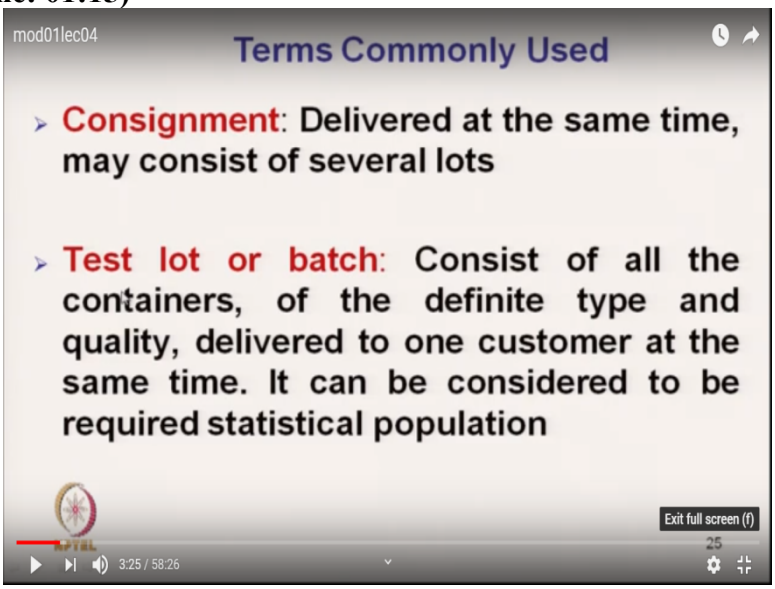

A consignment is that it is a delivered item, at a time okay. And it may consist of several lots, like and it is delivered from a particular supplier to a particular buyer. It is called consignment. Suppose one supplier is supplying 10 tons of yarn of 20's count, 5 tons of 30's count say, another 10tons for say of 50's count like that. This is order from a particular supplier. And he is supplying this order to that the customer at a time.

So, this total three different lots he is supplying one is of say 20's count, 30's count and 50's count lots he is supplying at a time. Once it is going at a time may be say 10 containers. Once it is going at a time then it is called one consignment. Similarly for fabrics also, for different types of design if it is going from one supplier to a particular customer at a time, that will be one consignment. And say yarn 20's count, 30's count and 50's count then they are going together as a consignment. But this 20's count yarn total 20's count is called lot okay.

And this test lot is statistically, it is a population. That means one particular lot, when it is coming at a time, same time or batch; it is totally statistical it is population. That means the test slot or batch, it consists of all the containers, say 20's count it has got 6 containers. So these 6 containers all the containers of definite type and quality, same quality delivered to one customer at the same time.

That is called the lot. If the same material is going in other day with other consignment that will be considered as other lot, okay. That is a lot. And one lot is taken as whole population as per statistics. So the population does not mean the entire material, which that customer has received throughout the month. It is not that. In a particular day, in a particular consignment,

whatever material is, coming in a lot that particular lot is known as the Statistical Population, Okay.

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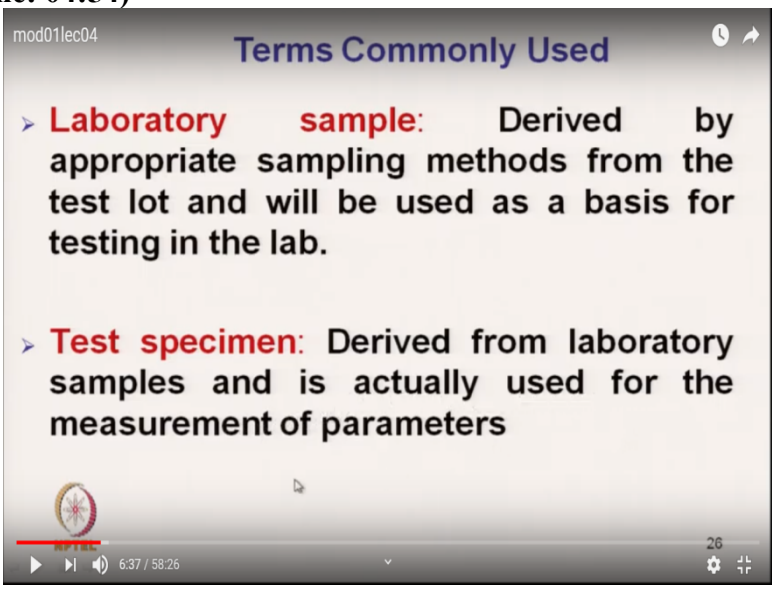

Then what is laboratory sample? So we have seen the consignment. We have understood the, lot. The laboratory sample is that using the statistical sampling technique from the lot population, if we take the sample that is called the laboratory sampling. We are used; it is derived by the appropriate sampling method from the test lot. Test lot means the whole material.

It is a part of the consignment and will be used as the basis of the testing in the lab. This sample, sampling we are doing only for testing in the laboratory that is why it is called laboratory sample. And from the laboratory sample say, we have got, say such 50 bobbins, and or say 500 gram 100 gram of yarn fibre, loose fibre. And from this loose fibre we need say, this much material for say, fibre fineness measurement.

Actually it is used for fibre fineness measurement. Or this much material fibre is used as a length measurement. So this is the actually the fibre is used. This is called the specimen. It is called the test specimen, which is derived from the laboratory sample and is actually used for the measurement of the parameter. So consignment and then test slot then laboratory sample and the test specimen. So for testing one must know these terms, okay to avoid any confusion.

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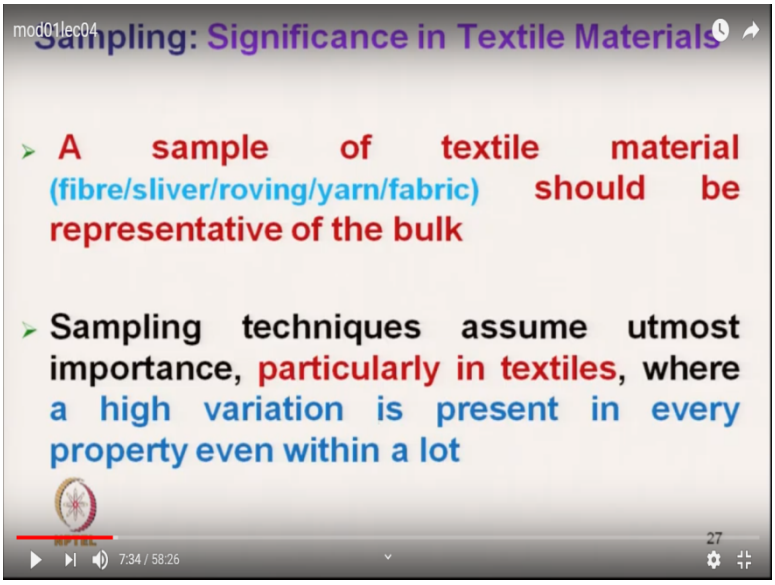

And sampling, the significance in the textile material; why sampling is important in textile material? As we have mentioned, the only reason is that the sampling of textile material fibre sliver, roving, yarn, fabric should be representative of the bulk, okay. And sampling technique assumes utmost importance, because the textile material is highly variable in nature. So for other material, other product where specific shape is produced, their sampling is not that important.

One can use randomly some material and test. But in textile material as it is a highly variable so we must follow specific sampling technique.

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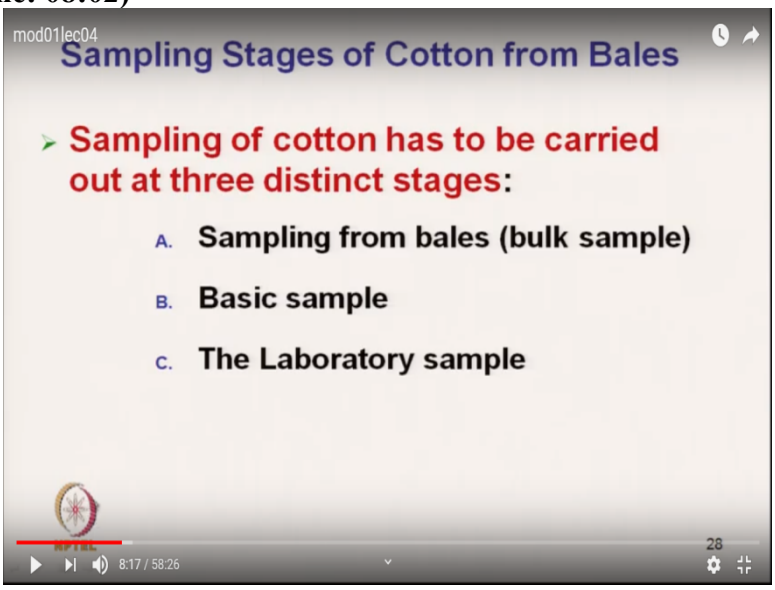

Now, coming to the sampling of textile material okay first, starting with the cotton fibre from bale. So, cotton comes in the bale form, okay. And sampling of cotton has to be carried out at three distinct stages, if we talk about the sampling from bale. First is that sampling from bale. It is a called bulk sample. First we have to take bulk sample. Then from bulk sample we have

to collect the basic sample. And from basic sample we have to collect the laboratory sample. This is these are the three stages of sampling of cotton fibre from bale.

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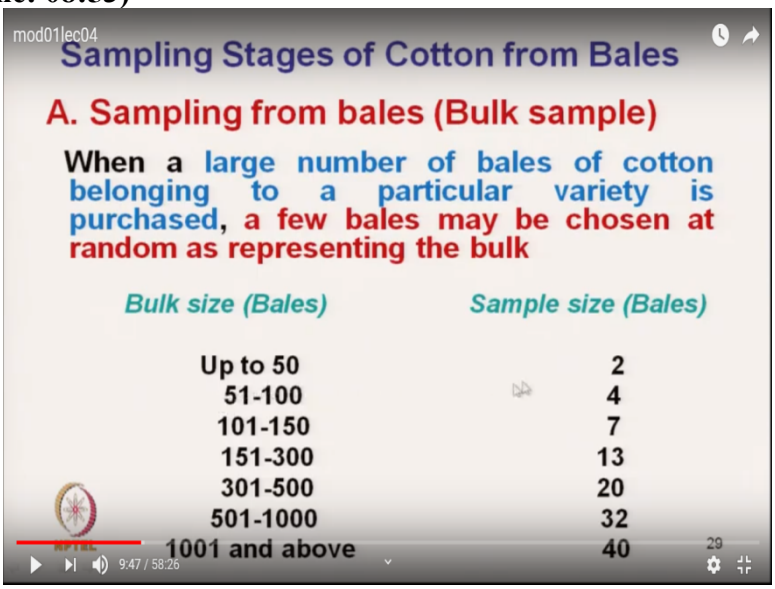

Now bulk sample, what is that? When a large number of bales of cotton belonging to a particular variety. Suppose we have got say100 bales, okay. Particular bale is purchased. A few bales may be chosen at random. So this selection has to be based on the random number. So few bales, we are selecting as a random numbering, okay as representing the bale, okay. So the bulk this few number, say 10 bales we have selected these are actually representing the bulk.

And the numbers of sample, there are some standards, if our bulk size is say 50, we can take 2 bales. We do not have to waste the material. Two bales at random; so 51-200, then 4 bales like that. So 1000 and above, so 40 bales, we have to select. This is the standard sample size, okay. And then bulk sample, what we have to do? We have to draw handful of fibre.

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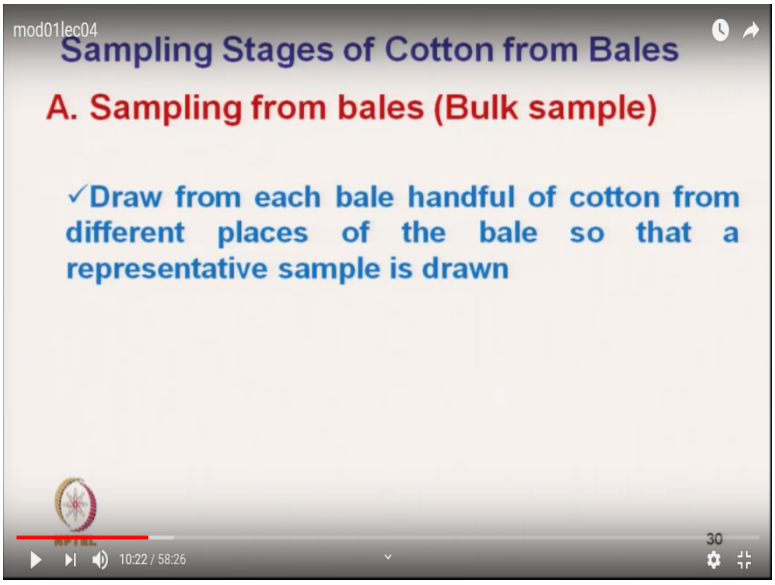

From different portion of the bale, so we just open the strap take samples, bulk samples from top, from centre, from bottom, different randomly which will be representative's sample, okay. After that so that bulk from the say, suppose we have in the consignment we have 100 bales. So we have selected for such bales and we have taken the bulk sample randomly from 4 bales.

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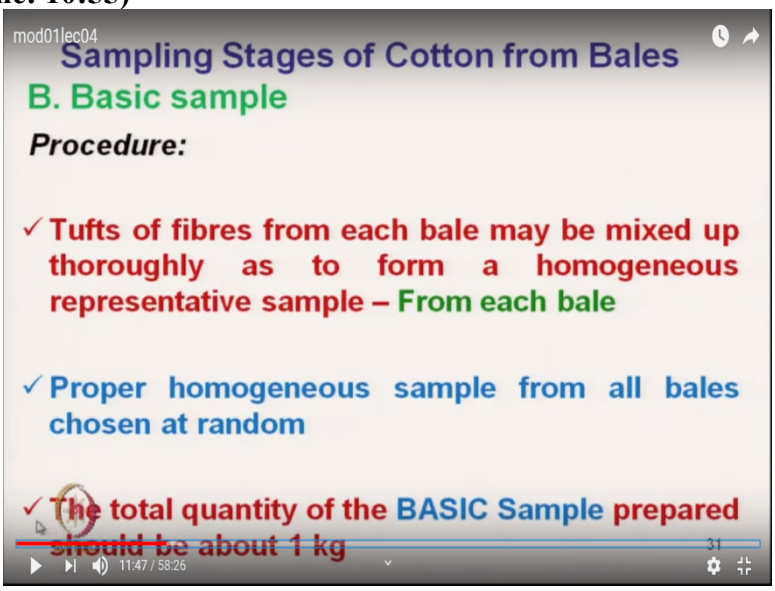

And then basic sample we have to take. The tufts of the fibre from each bale may be mixed up thoroughly as to form homogenous representative of samples. So from each bale but a, from different tufts, from particular bales we have taken sample from top, bottom, centre and then we mix the sample to may have homogenous mixture and from there we take select sample.

From each bale we select and proper homogenous sample from all the bales chosen at random, okay. That is the basic sample we have prepared and total quantity of basic sample

prepared should be around 1.5kg or 1 kg. So, that we have total quantity from different bale. So if we have say number of sample, number of bales is 40, then accordingly we have to take smaller one.

If we have say 2 bales we have to take 500 grams plus 500 grams Like that total basic sample quantity is roughly around 1 kg. So, basic sample is there. So it is there separate, separately mixed and depending on the number of bales, it is basic sample has prepared.

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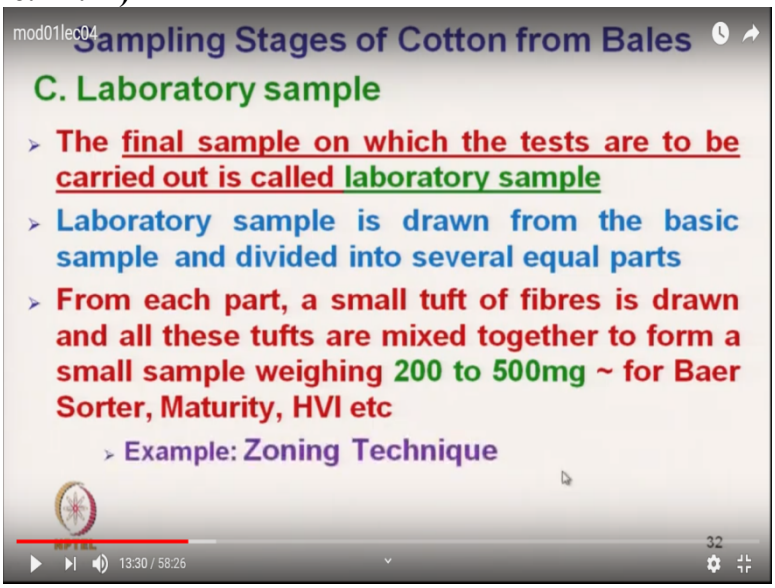

Then after that to have laboratory sample to find a sample in which the test has to be carried out, is called laboratory sample as we have already mentioned. Laboratory sample is drawn from the basic sample. So from those homogenously mixed sample, so that basic sample has to be prepared and derived into several equal parts, okay. And from each part, now here normally we use the zoning technique.

So, laboratory sample is prepared, then we take each part small tufts of fibre is drawn. And then and all these tufts are mixed together to form a small sample. So, the technique is used here is typically it is called zoning technique. And for all these maturity, HVI all these characteristics and example is zoning technique. We may, I will come I will discuss the zoning technique.

Here using the zoning technique one can get the laboratory sample ok. Before going to the actual sampling of fibres or yarns let us try to understand the concept of critical difference.

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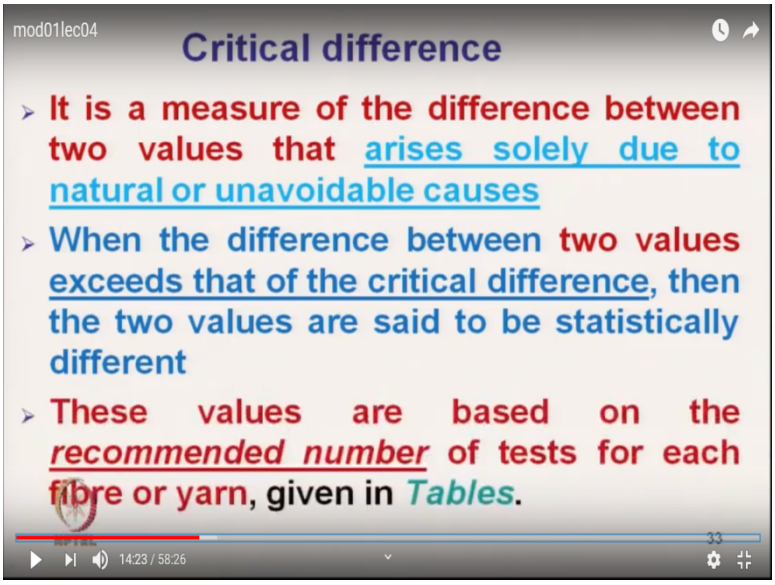

The critical difference is measured; it is a measure of difference between the two values that arises solely due to natural or unavoidable causes. It is due to natural cause. Okay, that is called critical difference. When the difference between two values exceeds this critical difference, then we can tell it is a statistically different, okay. And these values are based on the recommended number of test, for each fibre or yarn.

That is given in the tables. So I will give; show you in the table, so for a different type of test different type of test result the critical difference values are given.

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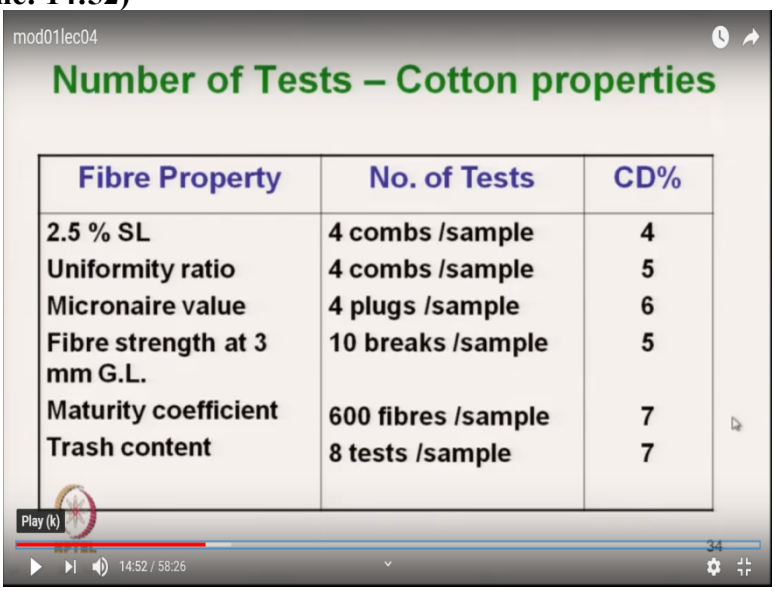

Like, see these are the standard tables available. Like for 2.5% span length if we want to get the critical difference, so number of test required for such combs. The sample for fibro graph is called comb, okay. Fibro sample are produced the sample in the form of comb that I will discuss. So, at least 4 combs per sample should be there. And Critical difference is that 4%. If the span length 2.5% values span length value is more than 4%, then the critical difference

the actual difference existing significant difference is there. That I will tell. For uniformity ratio again 4 combs per sample it is a fine. Micronaire value 4 plugs per sample it is a 6 like that. This is the for trash content 8 tests per sample 7%.

And Micronaire value, this is the value 6% just to remember the 6%. I will discuss I will give you one example in next slide, So that it will be clear, okay. I have taken only one example for Micronaire just to show the significance of critical difference.

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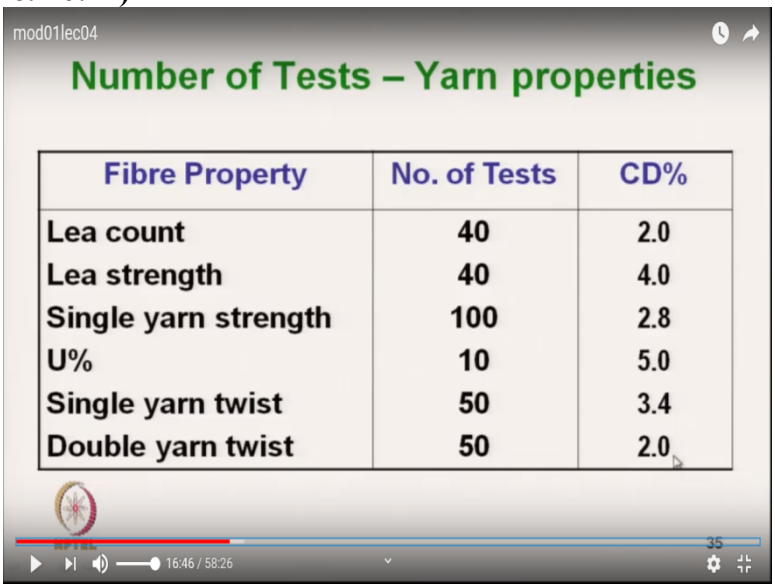

For Lea count for T test this one 2%. Like U% 10 test it is a 5. Double yarn twist 50 test it is a 2%. These are the critical difference, tabulated critical difference. And we have to calculate the difference based on the particular number of the sample.

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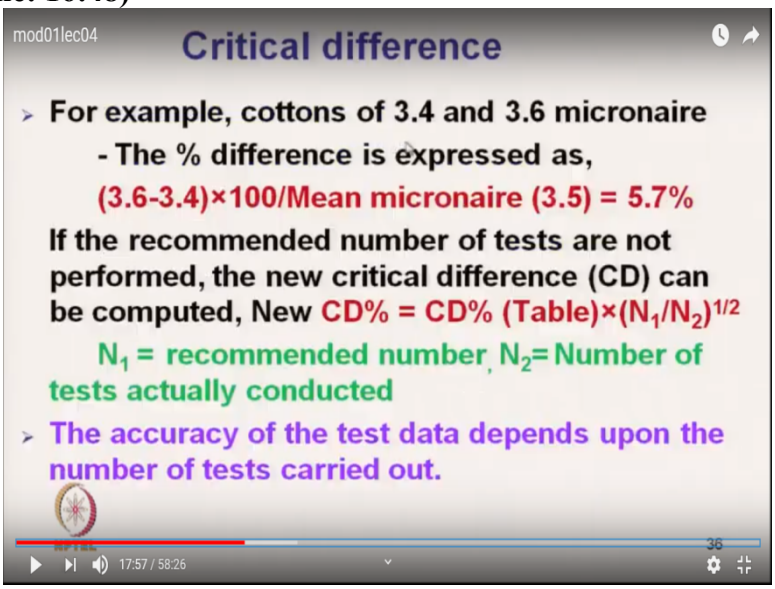

Now try to see the example here. Cotton is tested and it has got 3.4 and 3.6 values. Now we have to see whether these two cottons they have got their difference is exactly statistically significant or not whether this difference is other than the chance factor or not or natural

variation or not. So, critical difference actually gives indication of the natural variation. Because textile material they are naturally variable.

This I will come back going, I am going back to the slide again. So this 4% it is span length variation is due to the natural variation that has to be there. We cannot go beyond that, okay. That is how the; it is based on the experience. The, this data there is no it is a based on the statistics okay. So 3.4, is there and another test it is giving 3.6 value. Now we have to take this N why that this test difference is statistically significant or not.

The percent difference is expressed as 3.6 -3.4, that is the difference divided by the mean and expressed in percentage. Mean is here 3.5, 3.4 and 3.6. Mean is 3.5. So difference is 5.6. But the tabulated value which we have seen earlier, it was 6% which is less than that. So, that means we can tell this difference is natural. It is not due to other reason. There is no statistical proof that the difference exist.

And also the number of test 1 will go back once again. See number of test is a 40 number of test here it is a 40, number of test here it is 100. Sometime it may not be possible due to various reasons, that many samples test is not possible. Or sometime we may not stick to 40 or we may go beyond that 50. In that case we can calculate recalculate the critical difference, using this formula. The recommended number of test are not performed it may be less or more, the new critical difference can be computed.

You can, that is the critical difference new this is the tabulated critical difference, is multiplied by N 1/N2 and root N1/N2, where N1 is the recommended number as per table, N2 is a test actually number of test carried out. So using this formula one can calculate the modified critical difference and then compare the, see the, whether the test material significantly different or not, okay.

The accuracy of the test data depends upon the number of test carried out. That we will discuss separately, if we take the number of sample more, more the sample the confidence level will be more, and accuracy will be more.

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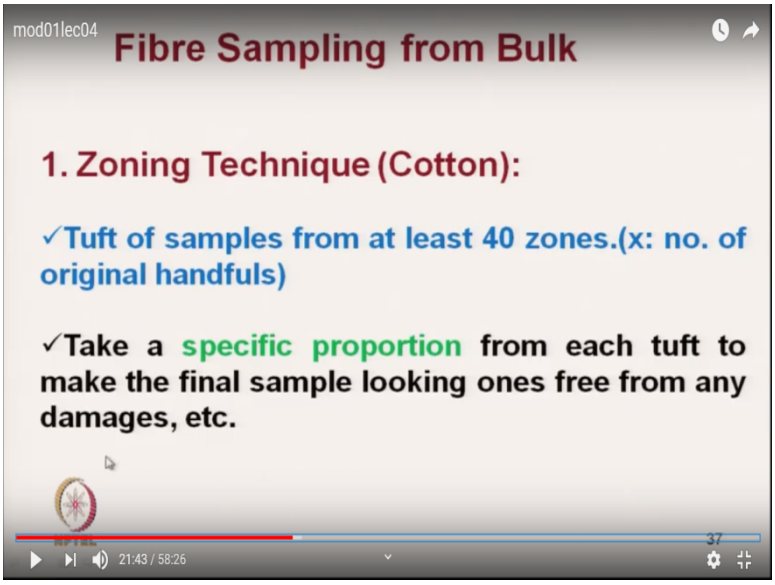

Now we will start with the sampling of textile material. First the sampling technique it is the; from bulk, we have to take the laboratory sample. And for cotton the sample which is the technique which is used it is called zoning technique. Now zoning technique it is not in any specific technique. It is a idea, it is there is no specific rule. One can formulate the rule.

Then one can go ahead with this. And I will explain one such norms; one such rule which is flexible okay. Say tuft of samples from at least 40 zones has to be there, okay. So 40 zones one has to create. So take a specific proportion from each tuft, to make the final sample, looking one free from any damage okay. So free from any damage you take the sample.

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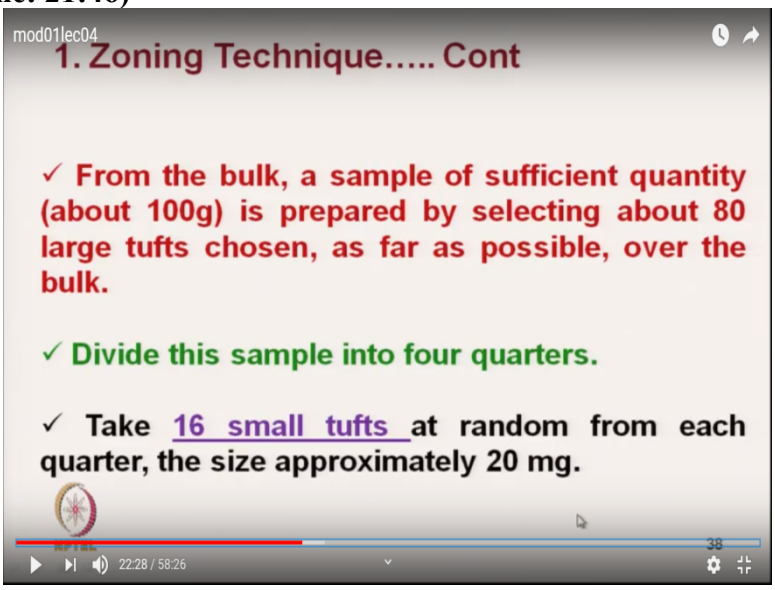

From the bulk a sample of sufficient quantity, say about 100 gram, we have to prepared by selecting about say 80 large tufts chosen, as far as possible over the bulk. So different tufts we are we have selected. Divide these samples into 4 quarters. So 4 quarters, it has been divided. Take 16 small tufts at random from each quarter the size approximately 20milligram.

So, from each quarter 4 quarter we have divided and then from each quarter we have taken 16 small tufts. So how much tuft we have got? We have got say 64 tufts, okay.

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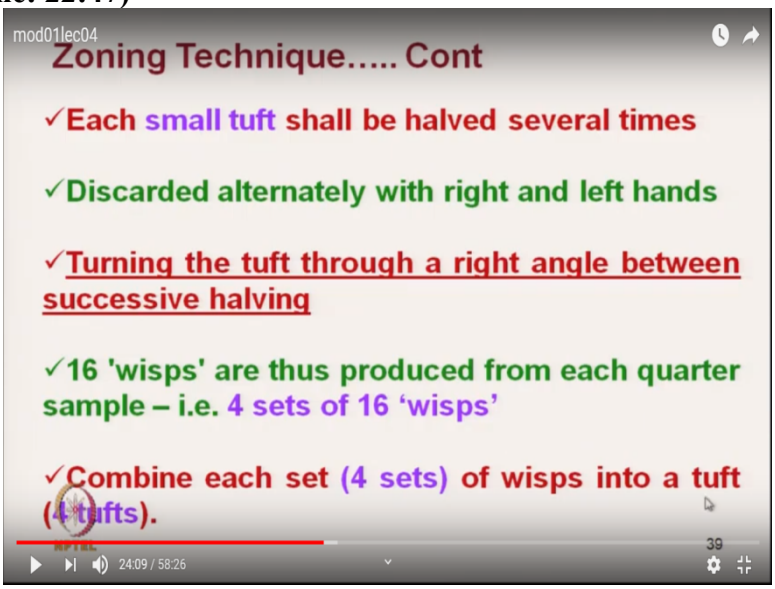

Each small tuft shall be halved several times. Like this is small tuft. So I am taking this one and discarding this. Then I am rotating again right angle and again I am discarding from this. In this way we have to several time, we have to take the halves, okay. Discard, alternately with right and left hands. So we have to discard the sample and keep on reducing the quantity. And after each tuft discussion, discarding then we have to rotate it.

So, that you are again randomising, turning the tuft through, right angle between successive halving. 16 wisps are thus produced from, each quarter of the sample. So these 16 wisps that is four set of 16 that is 64. Combine each set 4 set of wisps into tuft. So, we are getting 4tufts we are getting.

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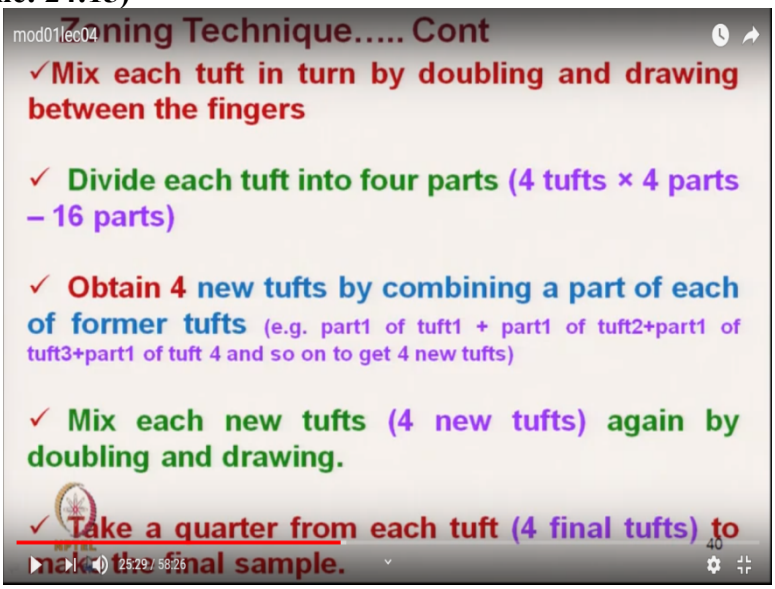

Mix each tuft in turn by doubling and drawing. So by doubling and drawing, we have to mix the tuft between fingers. So we have to again, so tufts we have to mix like this doubling and drawing. Divide each tuft into 4 parts okay. Obtain 4 new tufts by combining a part of each of former tufts. As for example part 1 of tuft 1, Part 1 of tuft 2, part 1 of tuft 3 and part 1 of tuft 4 are mixed together.

Similarly part 2 of tuft 1, part 2 of tuft 2, in this way we are mixing. Mix each new tuft, 4 new tufts again by doubling and drawing. So in this way zoning technique we will continue take a quarter from each tough go to, and then, we are making the final sample. So then quarter from each tuft by again discarding, we will get final sample.

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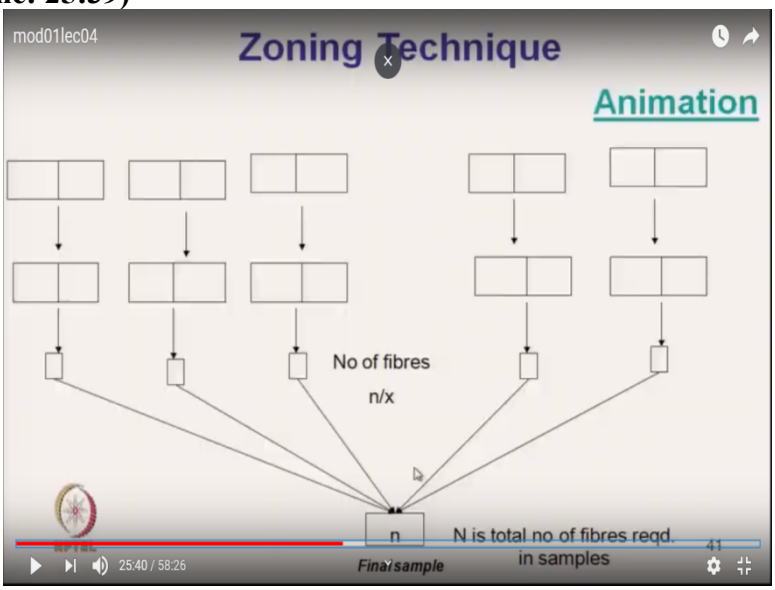

And that was different sampling technique zoning technique. One can have another simplified the zoning technique, okay. This animation will tell, here we have taken from different bales, tufts from different bales, okay, basic samples from different bales we have taken. And after that we are dividing into two parts, discarding 1 part, and again it is dividing into 2 parts, discarding into one part this is 1 part it is coming.

And then finally after several time repetition we are getting this final value final tufts and then we will mix these things together and this is called zoning technique. Because we are using at from different zone we are trying to take. And after every, after discarding every sample we are rotating it again. Now this animation will give idea.

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Try to see these are the initial sample. Now, it is dividing into two halves. Red one we have to reject. So we are discarding. And rest half we have taken okay. And this again we are dividing into two parts. By rotating okay, 90 degree, again it is a, we are discarding. In this way

amount of fibre, number of fibres are reducing .Quantity of material is reducing and ultimately the final quantity will be the addition of all these.

So this is the, if we know our required number of fibres required quantity of fibres so we can continue up to that point. Suppose we have say X number of, n number of this zones, in different zones are there. And say 20 zones are there. And we required say 100 gram.100 gram of fibre okay. So then each zone, we should continue up to the, point, where each zone will have say fibre 5 gram of material. So that we mix all this, we will get 100 gram. So this is zoning technique which is very simple.

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And Zoning technique the advantage is, that there is no specific rule of zoning technique. One can formulate zoning technique on his own for the industry, okay.

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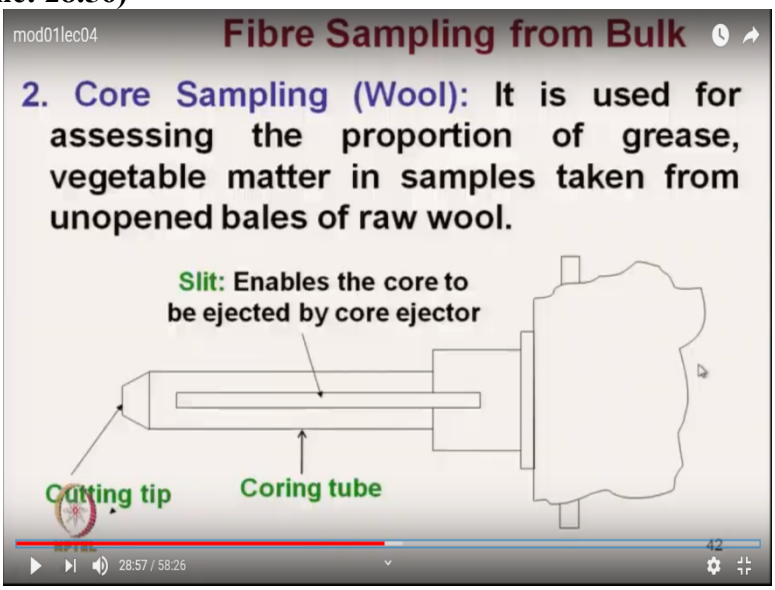

Next is that wool sampling from the bale. And which is very important for wool fibre because the wool raw fibre it is highly sticky. And to get fibre from the bale it is not so simple. It is not easy because it is a very highly compact. So we have to take fibre from the wool. We cannot open wool bale so easily okay. We have to take the lump from the surface and then only we can open. It is not it is very difficult to take sample from the centre of the bale.

So, the core sampling is used. So it is used for assessing the proportion of grease vegetable matter, in the sample taken from unopened bale of raw material, okay. So it is basically used for to measure the grease content. And to some extent we can test the diameter. But we cannot test the length of fibre because here it consists of a cutting tip. This is a tube coring tube this and through this cutting tube, it penetrates this and here this is the plastic bag, just to store the material.

And the slit is there enable the core to be ejected by core ejector, okay. Core has to be ejected okay. So this it consists of this tube and cutting tip.

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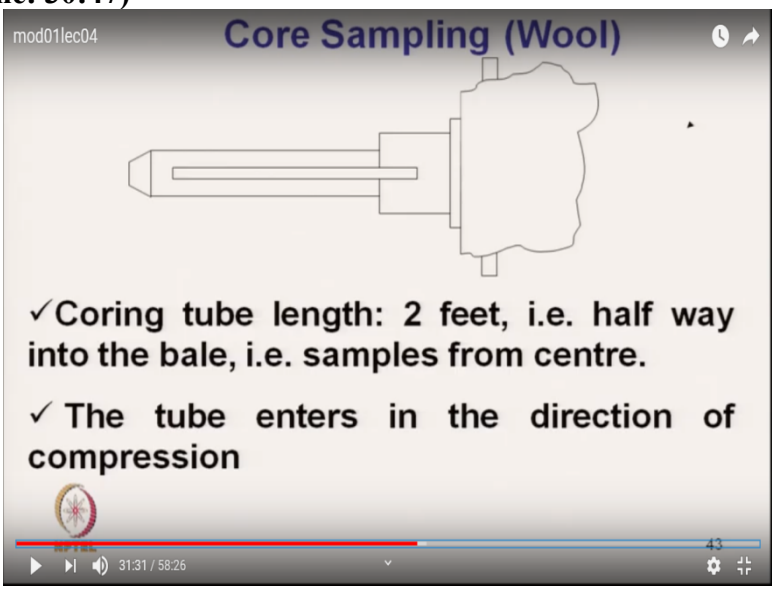

Now the coring tube length, it is approximately 2 feet length. So, if we see the wool fibre, wool fibre bale it is typically 4 feet. It is a total height is a 4 feet. So it is 2 feet because if it penetrates it is reaching up to the centre, okay the Halfway into the bale. That is sample from the centre we can take. The tube penetrates in the direction of compression. Because the fibres, it does not penetrate vertically, it penetrates directly where the compression side is there. So perpendicular to the layer of the fibres it penetrates.

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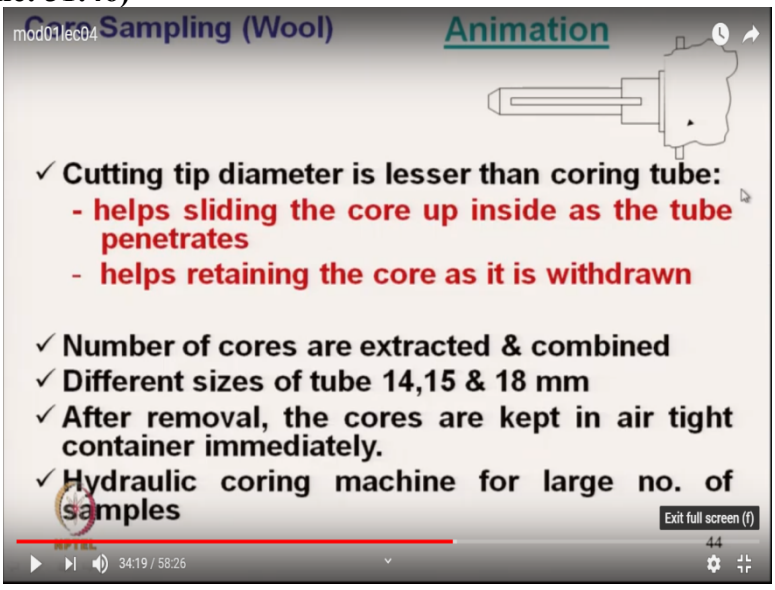

The cutting tip diameter is less than the coring tube, the core tube diameter. The advantage is that it helps the sliding of Core. Core means the cut wool fibre. By the cutting tube, when it penetrates when it is pushed the fibres are cut. It forms a cylindrical core. The core diameter

is equal to the cutting tube diameter, which easily penetrates inside the coring tube that is why this diameter is smaller.

Another advantage is that it helps retaining the core, as it is withdrawn. So because when the material when the wool by that coring tube is withdrawn, the core should be inside the coring tube. It should not come back. So as it is smaller in size after penetrating the core gets expanded and so the coring tube when is withdrawn the core is remains in the coring tube. The numbers of cores are extracted and combined.

So, there will be a number of cores will be extracted and this they are stored here. So each core will have certain quantity. And after that the core is actually transferred to this plastic bag. Okay. Different sizes of tubes are there 14 millimetre, 15 millimetre, and 18millimetre, depending on the type of wool. After removal, the cores are kept in airtight container immediately. So this is the polythene bag.

So, after that core is taken and then it is air tight container is there, because otherwise wool will absorb moisture and total characteristics will change. So, we do not need to open this polythene sheet, polythene bag. So that it should not get exposed to the environment. And Hydraulic coring machine is there for large number of samples. Coring machine it is automatically hydraulic pressure is there. So it penetrates automatically. Now let us see the animation here.

Video Starts: 34:33

This is the coring tube and it is a bale of wool fibre. And it is penetrating. It is penetrating inside and this is one core has been withdrawn, okay. And this tube is full of the core so that we have to remove this core. So you have to take vertically, it is a, then this core will be stored here okay. And another core, then you keep on repeating until or unless the required quantity of the material is collected. So, next core is there. So this is the coring technique. Now, here one important thing is that this coring tube is cutting the fibre.

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The coring tube this, due to this, it is cutting the fibre. So we have to select, we have to test those parameters only which are not actually dependent on the cutting of the fibre. So we will not definitely test the fibre length. We will, try, here, it is used for grease content, which is very important, which does not actually depend on the length whether it is cut or not does not depend okay. And to some extent the coring the sample is used for the fibre diameter.

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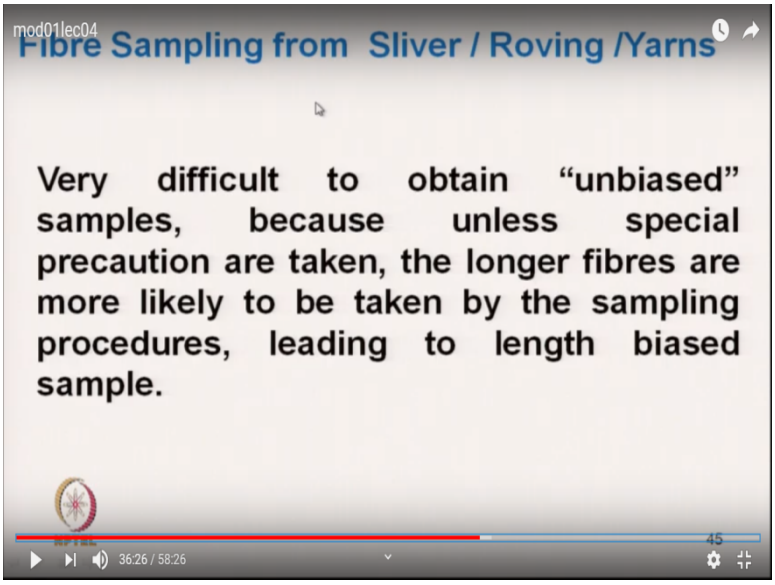

But from long fibre also measure the fibre diameter. Now fibre sampling from sliver, roving or yarn, it is very difficult to obtain unbiased sample. Because unless special precautions are taken, longer fibres are more likely to be taken by the sampling procedures leading to a length biased sample. So as I have already mentioned, so if we try to take the sample from the bulk also. If we try to pick the sample, we are actually selecting the length biased sample.

Even for this sliver if we try to pick. We are trying to take the length biased sample because longer fibre will have chance more chance, higher chance to be selected. So there are two ways of counteract this problem.

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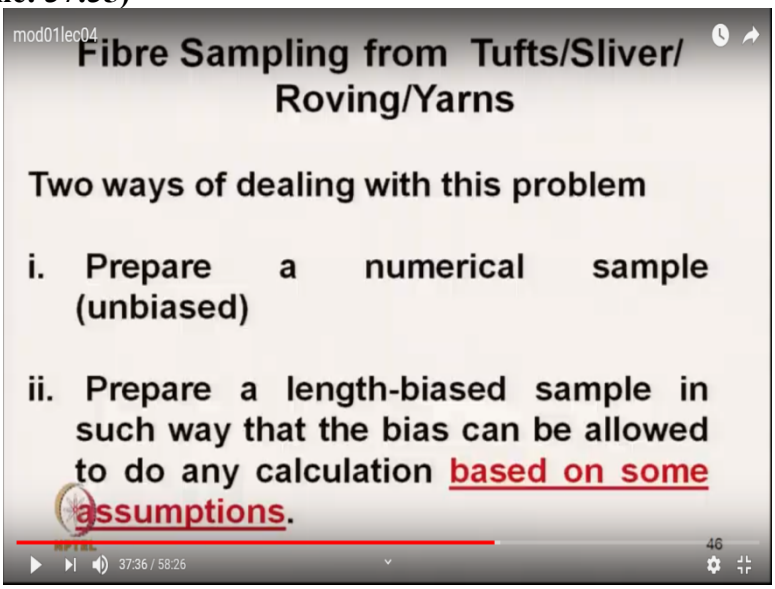

One is we have to; we can prepare the numerical sample, which is actually which is different from length biased sample, which is unbiased sample. Another way is that to prepare a length biased sample in such a way that the biasness can be allowed to do any calculation based on some assumptions. So there will be some assumptions. So first we take the length biased

sample and then we can calculate based on the knowing the fact it is a length biased. And then we can assume some assumptions okay.

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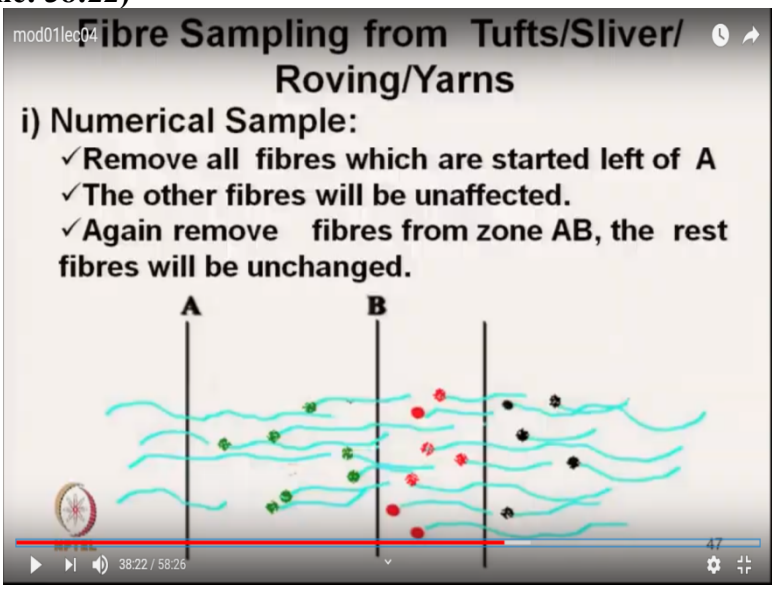

First we will discuss the numerical sampling. Now in this numerical sampling, we remove all the fibres which are started at left of the line A. This is the sliver. Suppose it is a sliver. We are trying to discuss the, this is the sliver. So in a sliver suppose it is a; we have drawn imaginary line A, B, C, D like that, okay. First we decide we take all the fibre which are at the left side of the line A.

So, it we have we had taken out 1, 2, 3, 4, 5 fibres. Now, this removal of these fibres is not affecting the fibres which have end point at between A and B. So removal of all fibres each are started left of A point. The Other fibres will be unaffected. So if we remove all these fibres other fibres will be unaffected. Again removing the fibres from zone A B, this zone there with the green pointed fibres, if we remove all these fibres, the other fibres will be unaffected.

Like red pointed and black pointed fibres will get unaffected. In this if we keep on taking the fibres, there the longer fibres whether fibres are longer or shorter they have got equal opportunity. So the numerical sample is taken from the end point of any parallely arranged fibre strand. But we cannot draw numerical sample from a fibre tuft, randomly oriented fibre tuft we cannot draw or a numerical sample.

Here whenever wherever we try to take, it will be the length biased sample. But in a parallely oriented sample, it may be roving, may be sliver or may be yarn if we take the fibres sample from the end point. We are taking the fibres irrespective of the length. Here the length of the fibre is not coming into picture. So both short fibre and long fibre all the fibres irrespective of

length, will have equal opportunity to get selected. So that is why it is a numerical sample, okay.

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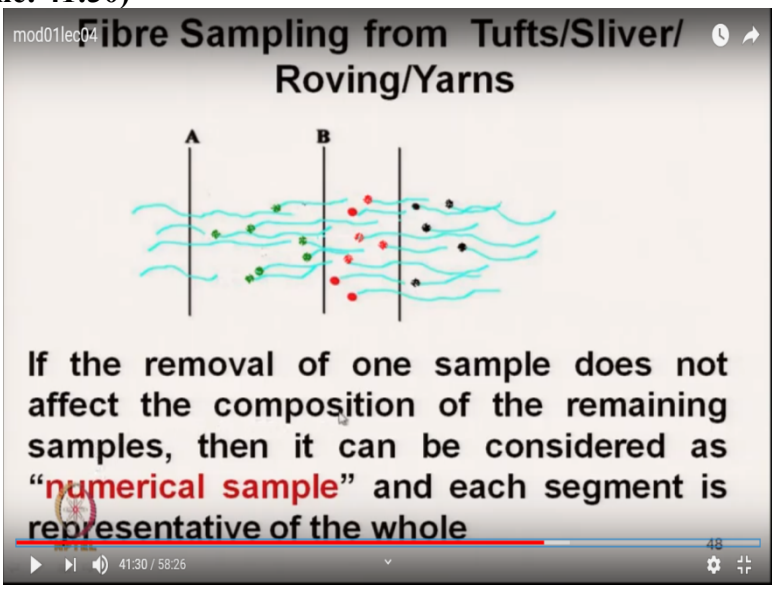

If the numerical removal of 1 sample does not affect the composition of the remaining samples, then it can be considered as a numerical sample. That means if we remove this all the fibres left of which that end point at the left of B, this will not affect the composition of other fibres. So that is why I here it is a length unbiased sample okay.

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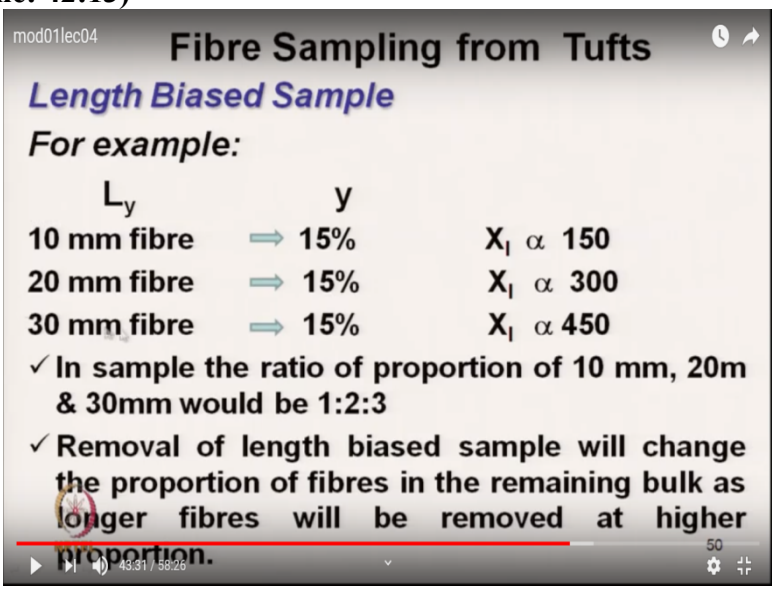

And what is the length Biased sample? In length biased sample the samples of higher length will have the chance of getting selected more probability of getting selected. And in length biased sample this is the equation Xi is proportional to the Ly multiplied by Y, where Xi is the proportion of i length group in sample. So this is the proportion of i length group in a sample. If we take the length biased sample from the bulk, so i length group there are different length group 10 millimetre, 20millimeter, 30millimeter, group.

So i length group, so this is the proportion of the, i length group in the sample. And Ly is the length of fibre with proportion Y%, in bulk, okay. So this is the and ultimately this proportion in the sample is totally different from the proportion in the bulk. So one example is there Ly, what is Ly is the length of fibre with proportion of Y% in bulk. So this is the bulk proportion. So let us say in bulk it is a mixture of fibre length of 3 groups.

So, 10 millimetre, 20 millimetre, and 30 millimetre, okay. And there are various other groups are there other factors. So, 15 millimetre, 25 millimetre, so 10 millimetre, it consists of 15% in the bulk. 20 millimetres the fibre is 15% in the bulk. 30 millimetre, 15% in the bulk. So in the bulk if we see it means so 10 millimetres 20 millimetres, 30 millimetre, are equally mixed in the bulk.

But when we take the length biased sample suppose here this is the tuft from tuft we cannot do the numerical samples we have to do the length biased sample. So, from tuft, suppose in this tuft it is a mixture of say 10 millimetre, 20 millimetre, 30 millimetre say 15% fibres are there. Other lengths are equally say a different proportion.

Now here if we see, if we take the sample, what will be the proportion of the length biased sample in the sample as per the length. So for 10 millimetre fibre, for length what the proportion here was 15%. But in the bulk in the sample it will be 150 because it is a multiple of 10 multiplied by 15, so it is 150. Similarly 20 millimetre fibre, it is proportion is 300, 30 millimetre fibre, it is proportion is 450.

So, if we take the actual proportion in the sample, of this fibre the short fibre that is 10 millimetre fibre: 20: 30 millimetre fibre, it is a 1:2:3. What does it mean? In the bulk, the sample proportions were same 15% each that means 1:1:1. But when we are sampling, we are taking the sample, it is proportional proportion has changed depending on the length of the fibre. It has it is proportion has become 1:2:3.

That means 30 millimetre fibre, has got three time probability to that of 10 millimetre fibre due to the length. So that is the length biased sample, okay. So it is a multiple of the fibre length and the proportion in the bulk. And if we remove say, if we remove the length Biased sample in the bulk 10 millimetre, 20 millimetre, and 30 millimetre, was 1:1:1 equal. But if we remove 1:2:3 fibre, that means and the bulk the remaining portion, here the total proportion will change.

Because here in the bulk the sample we have taken more, longer fibre, so, longer fibre proportion will reduce here. So removal of length biased sample will change the proportion of fibre in the remaining bulk as the longer fibre will be removed at higher proportion in the sample okay. So, this changes the characteristics of the bulk. But in numerical sample it does not change the characteristics. Like, I am taking numerical sample from this sliver in this way. So, bulk characteristics remain same okay.

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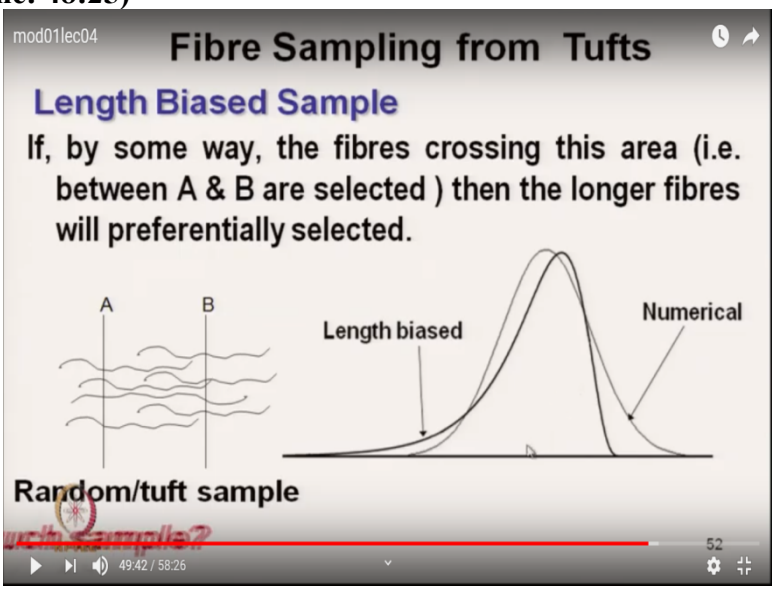

And the Length Biased Sample, the chance of fibre crossing the line A and B is proportional to it is length. So, this lines within these zone. The chances will be more for longer fibre. So random tuft sampling, so this is the length biased sampling and if by some way the fibre crossing in this area between A and B, we can select. So fibre crossing between A and B zone if we can select, then it will be length biased sample okay.

So the longer fibre will preferably selected okay. So, if we see it is a numerical sample in the numerical sampling it is a proportion is same okay, long fibre and short fibre. And in length and sampling, if we see length the will be little bit high. It will it will give us the idea of longer fibre towards the higher length. And then, so how will you prepare such sample. So length biased sample how to prepare this length biased sample.

So, numerical sample, we have discussed like if we draw the fibre from the edge from a parallely arranged fibre strand that will be numerical sample. But length biased sample we can prepare Fibro sampler which is used in fibro graph where this is the fibre tuft from and one clamp is there. Clamp will is moving through the fibre and it clamped. It takes the fibre, it picks the fibre and it picks the fibre from different point. It is not the; it is taking fibre from the meet verse end point. Now try to see in fibro sampler

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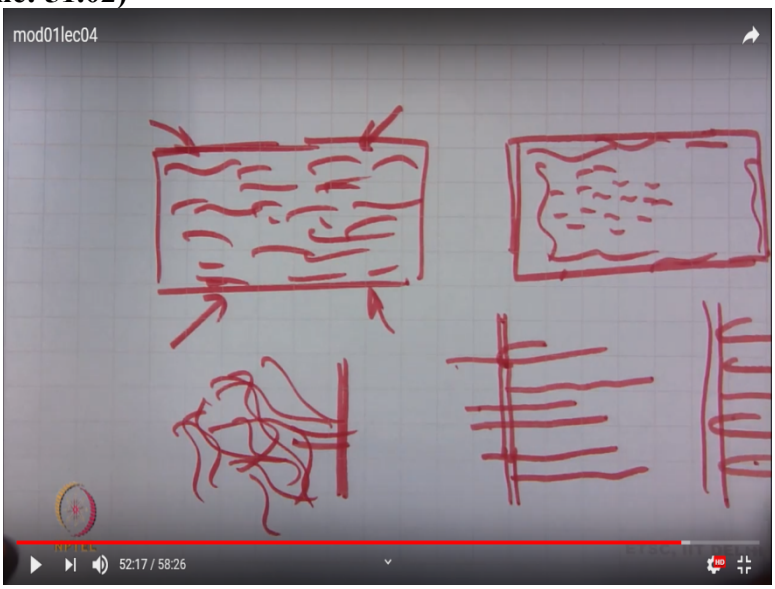

Fibres are arranged in this manner. These are the fibres and what fibro sampler is doing this is the fibre. It is a clamp. It is moved through the fibre okay. And the fibres are actually selected or caught at different point, okay. So this is in random. One, so, this is supposed a clamp. This fibre is gripped at this point and other fibre will be gripped at the end this way. At different it is gripping the fibre, okay, at random point.

And after that what will happen, this will have folding. This end will not be remaining here. This will remain fold. So ultimately this will be like this.

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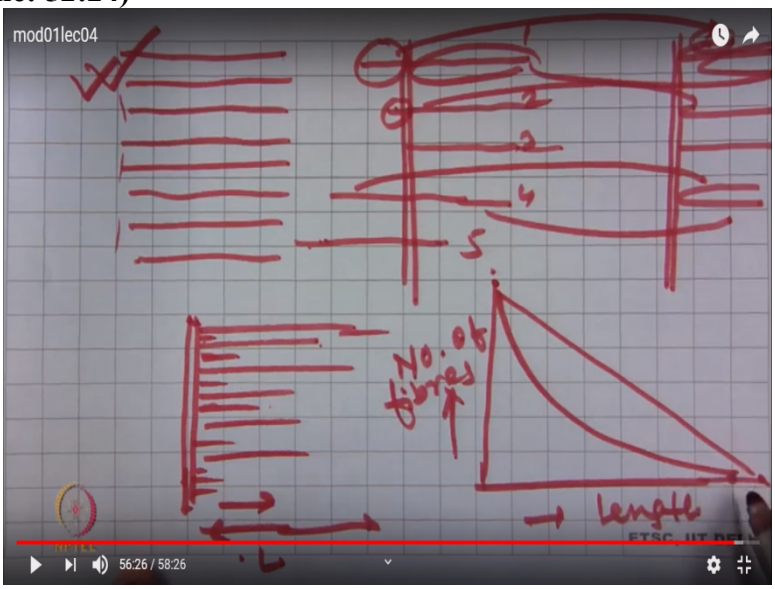

Now, suppose all the fibres they have equal length. I am trying to take, say, sample of say, polyester just for trial, okay. Now this fibre will, this clamp will, grip the fibre at different point. So this fibre is clamped at this point, okay. This fibre is clamped; at this point. This

fibre is clamped at the end point. This fibre is at the middle. This fibre is at this point, say like this. Okay. Now after that the third one point is that so fibre 1, 2, 3, 4, 5.

Fibre 1 will get folded okay, by the clamp in the clamp. So due to it is flexibility it will form a loop like this. This portion becomes here this is the portion. And this portion remains here, the longer portion. This fibre is selected at this point, almost at the edge. So this will form smaller length. This is the loop here. This fibre is straight at the end point. This fibre will form this loop. So this is the portion and this one is this portion okay.

So, finally if we see, finally for I am talking about the fibre of same length, finally if you see this is the, clamp if we see the fibres, this is the long fibre. And our assumption is that fibres have chance to be select cut at any point okay and all the fibre they have equal chance and if you see the density of the fibre number of fibres and verses length. Suppose this is the number of fibres and this is the length. From the comb this is the length okay. Here number of fibre will be maximum, okay. And then it will keep on reducing.

And for this say cut polyester fibre this curve will be, this is the fibrogram of cut polyester fibre. And for cotton the density, the number of fibres or density of fibres, density of the cluster is, because it is in a photoelectric method. It measures the light penetration depending on the density. So, cotton it shows, this is the nature. That means the maximum length it is almost it will be a longest fibre. But this curve is called fibrogram okay. This we will discuss when will discuss the fibre length okay. So this is the length bias technique.

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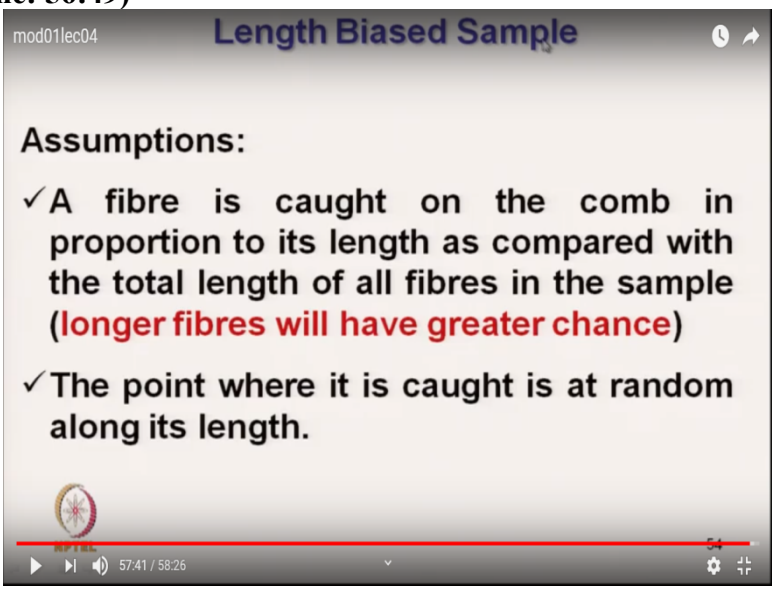

And the assumption here is the two main assumptions. One is a fibre; a fibre is caught on the comb in the proportion to it is length as compared to the total length of the fibre in the sample. That means fibres with higher length will have equal will higher proportion. But in

our example we have taken for polyester as the all the fibres have the same length they have equal all the fibres have equal chance.

But in cotton longer fibre longer fibre will have greater chance. That is the first assumption and second assumption is that, the point where it is caught is at random along it is length okay. These are the assumptions. Based on these assumptions or we can, if we know this assumption, then we can actually take precaution to have to know the actual fibre length okay. We will stop here today and we will continue with this in next class. Thank You.