Evaluation of Textile Materials
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Module No.#01
Lecture No. # 02
Evaluation of Textile Materials – Outline (contd.)

Hello every one. We will continue with the over view of the course. Okay. So in last class we have discussed about the topics on Sampling Methods.

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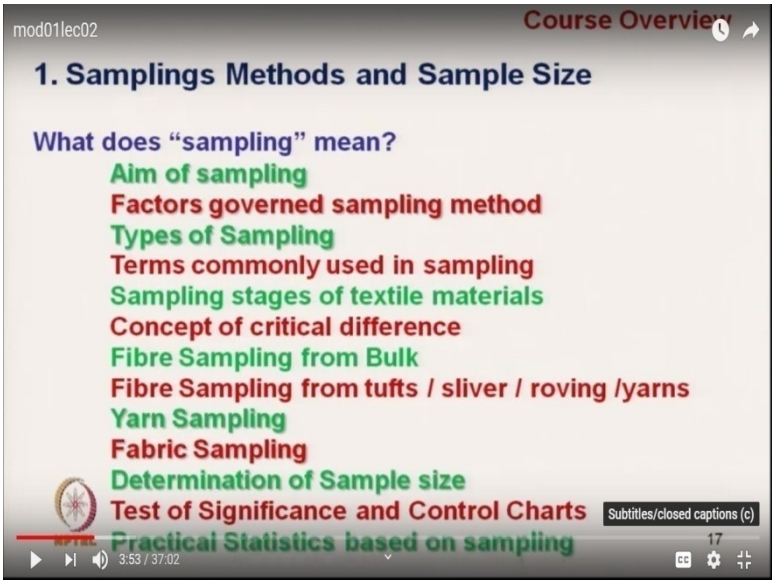

So, there Sampling methods and sampling size we have discussed that; we will cover the meaning of sampling. Then aim of sampling, then factors governed sampling method, type of sampling, Terms commonly used in sampling, sampling stages of textile materials, concept of critical difference, Fibre sampling from bulk, fibre sampling from tuft, sliver or roving or yarn.

Because this sampling of fibre is from bulk or from tuft, this is a tuft. Bulk is in the form of say bale, okay. It is entirely different. Tuft is soft one okay. From here we can take the sample, okay. But for from the bale we have to take different precaution ok that those we will discuss and from sliver the sampling if we try to take it is entirely, it is extremely tricky. Okay. Now I will give one example although we will discuss later also.

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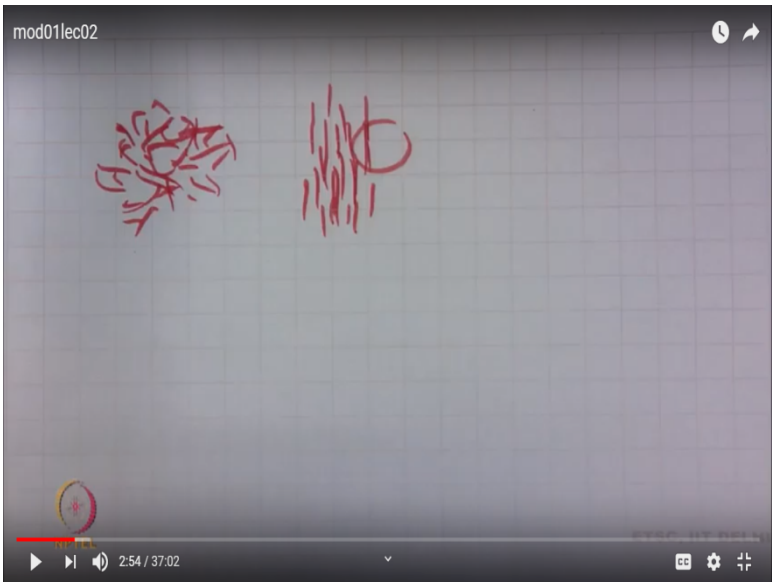

Suppose this is the tuft okay, where the fibres are randomly arranged okay randomly arranged. So we can pick up small quantity of tuft okay. There it represent entire quality entire because here we have short fibres, we have long fibres everything is there okay. But in sliver if we see this slivers are arranged in a particular order. Say parallelism here if we try to pick sliver from the side.

Suppose I am trying to fix sliver, fibre from the surface. There the problem would be that the longer fibre will have more, higher probability to be selected. That means it will create a length biased sampling. On the other hand if we try to pull the sample from the edge from the end then it will not create the length bias sample and detailed we will discuss. And then yarn sampling how to sample yarn, then fabric sampling determination of sample size test of significance and controlled chart and practical statistics.

So this will be discussed. All this will be discussed in the sampling method and sample size that segment initial segment okay. Next we will start the actual testing of textile material.

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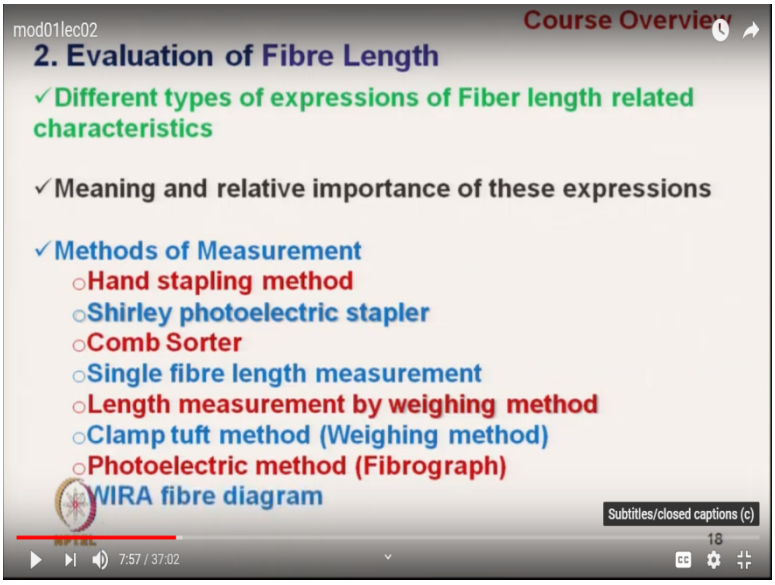

We will start with the evaluation of fibre length okay. Different types of expressions of fibre length and related characteristics. Like fibre length are expressed at with by a different terms, it is not the fibre length. We sometimes call it as mean length; we can call it as span length. Span length is also the divided into various terms 2.5% span length, 50% span length, okay. And this staple length, upper half-mean length, so for upper quartile length so various terms Okay.

This definition, these terms we will discuss in detail okay. And we will try to understand the importance of this terms and how to use this terms in practical in actual application okay. Meaning and relative importance of these terms; what are the meanings and what are the importance of these terms? Okay. Then methods of measurement, various methods of measurements are there, okay to test the fibre length and their dispersion.

These methods are, first, we will start the hand stapling method, then Shirley photoelectric stapler. So this hand stapling method, it is by hand. We quickly we come to know the length, characteristics of the bulk of the material. And it is mechanised version is same characteristics we measure. Here it is a staple length by Shirley photoelectric stapler. It is a mechanised version we will discuss in detail.

Then comb Sorter method where we test the effective length okay. Then single fibre length measurement so we will discuss the how to measure the single fibre length. Then length measurement by weighing method, we can take the mass and then based on the mass and the

class size we can calculate the length of the fibre. Another weighing method is it is called Clamp Tuft method.

Clamp Tuft method it is used mainly for sliver and all this type of are those are almost parallel in nature. So here we use if you want to test the length of the fibre from the sliver we use Clamp Tuft method. So, various methods they are used for different types of fibres. Then, photoelectric method it is a very popular, it is a widely used method it is called fibrograph method. So where we get the span length or upper half mean length okay.

This will discuss in detail, their principle. And related numerical also we will discuss okay. And then in photoelectric method main technique is that, tricks is that the sampling method. How to produce the sample fibre, sample and there to the students there are confusion how to test the how to select the sample. These details, I will discuss here okay. Photoelectric method and related numerical's the things will be very clear okay.

After then WIRA fibre diagram it is basically for wool fibre, so it works in the capacitance principle, then we will fibre length by Almeter. Okay. So these are the methods okay. And in HVI also the used but it is almost fibrogram method, HVI they use the fibrogram method.

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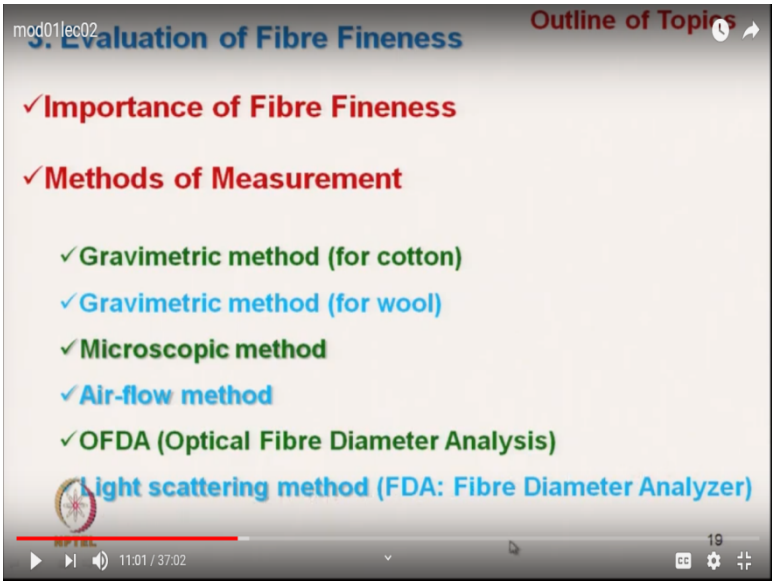

Next is the evaluation of fibre fineness. So fibre fineness normally in any other Engineering material if we want to know the fineness we simply calculate the measure the diameter. Any material so fineness of rod, fineness of wire so it is a simply measure the diameter. But textile

material it is a Complex material. Here we cannot measure directly the diameter. Because of various reasons those we will discuss little.

Because the fibre they are not circular in nature; they are not uniform. So that we have to measure the fibre fineness indirectly and most popular expression is that fibre mass per unit length that is the indication of fibre fineness. So what are the importances of fibre fineness that we will discuss? Why do you want to measure the fibre fineness? So this we will discuss here. Before we measure, we discuss the methods. Okay.

We must know the importance of fibre fineness, then different methods of measurement. There are various methods we will discuss each and every methods. First is the gravimetric method. It is for cotton. Next is that gravimetric method for wool. So there are two different gravimetric methods that we will discuss. Okay, then microscopic method of measurement, so, microscopic method of measurement is basically for the fibres those who are actually circular in nature.

So, that is basically for wool we use microscopic method. Because wool more or less it is circular in nature. So that is why wool, if we see, cotton is expressed in terms of mass per unit length. But wool generally is expressed in terms of Micron micrometre. Because wool is little bit circular in nature. Wool is not expressed in gram per or mass per unit length. Wool is expressed in terms of Micron. Okay.

Then method is that air flow method which is indirect method of knowing the fibres mass per unit length, then Optical Fibre Diameter Analysis. This we will discuss OFDA. And next is that light scattering method fibre diameter analysis. FDA method detailed we will discuss here. Okay. And another important method it is a vibration method using the principle of vibration of string. We can measure the vibration fibre, mass per unit length. Okay. So after evaluation of fibre fineness next we will start the maturity.

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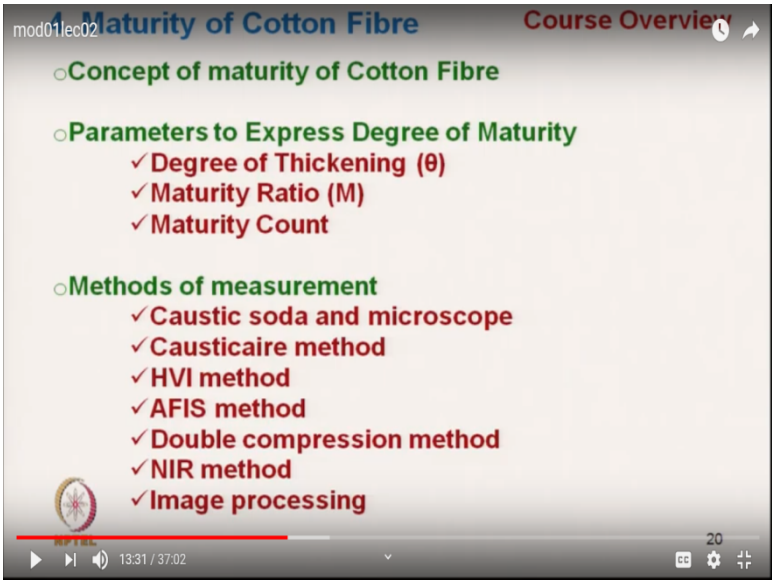

Maturity basically it is only a matter of the Cotton. It is maturity is limited to Cotton. Other fibres we do not measure the maturity okay. And maturity affects the immature fibre affects the quality of material adversely. Okay. Those detail we will discuss, so concept of maturity of cotton fibres. So here we have mentioned that maturity of cotton because we are not going to discuss maturity of other fibres. And for definitely for manmade fibres, we do not have, we do not need maturity.

So concept of maturity of cotton fibre and there are various parameters to express the degree of maturities. That those we will discuss to understand these parameters. So these parameters are degree of thickening, maturity ratio, maturity count. So, these are the expression of maturity. Then we will discuss the various methods of measurement of maturity these methods of caustic soda and microscopic method.

It is a very common method. It is used for cotton fibre. That is obviously cotton is only concerned about the Cotton, Caustic soda and microscope. Then Causticaire method it is indirect method of measuring the maturity which also takes care of which uses by using caustic soda also here. But method is different that we will discuss here. High volume instrument method of measurement of maturity although here they use the air flow method.

AFIS method of measurement of maturity, so, then double compression method of measurement of maturity, this we will discuss near-infrared method of measurement of maturity, image processing method of maturity. So these are the methods will discuss.

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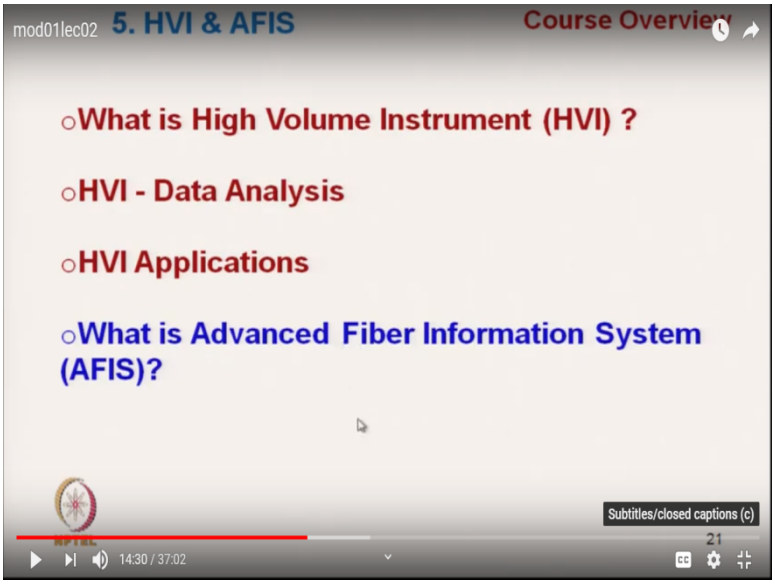

Next we will discuss the basically two methods which are very popular for very quick use quick data okay. One is called high volume instrument HVI. And there in that instrument we test a number of characteristics together. It is not the same single length okay, length fineness, strength everything. We can even here; we can test the colour, trash percentage that we test. So this principle of HVI we will test.

And there how to analyse the data, this we will try to understand here. Similarly an application of HVI, then another set of method that is called advanced fibre information system AFIS system where again we will see the sorry AFIS data analysis and that application of AFIS.

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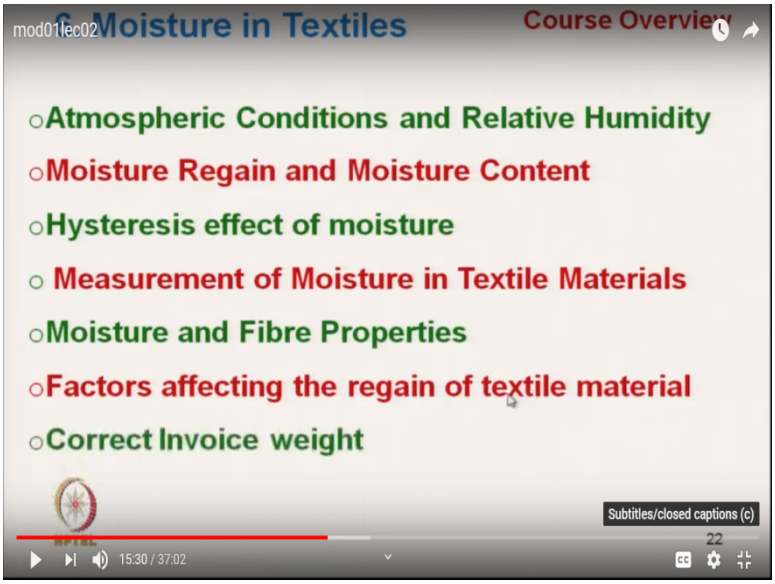

After that in the Sixth segment, we will discuss the moisture in textiles. Okay. So first we will discuss the atmospheric condition and relative humidity. What is relative humidity? How to measure the relative humidity? This we will discuss here. And there are two very commonly used term in textile. It is a moisture regain and moisture content. These terms we will discuss in detail. Their relationship we will discuss, then hysteresis effect of moisture, then how to measure the moisture, quantity of moisture in textile.

And what are the effects of moisture on fibre properties that we will discuss. And what are the factors which affect the moisture regain of textile material. And one important application of my series is that to calculate the correct invoice weight which is very important. Because we test that we actually produce the material and customer is paying for the material. Not for the moisture. But it is also not feasible to have to give the exact dry weight.

Because textile materials are hygroscopic in nature, the moisture has to be there. It will be there. We cannot avoid. So internationally it is accepted that the moisture has to be there. The standard allowable moisture is there and considering that allowable moisture. So we can calculate the correct invoice weight. So the process of calculating, how to calculate and what are the uses we will discuss here. Okay.

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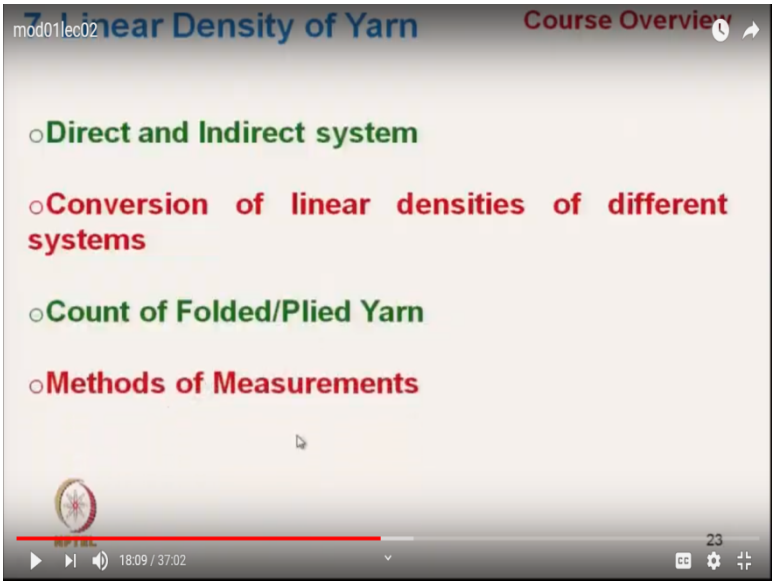

Next is that linear density of yarn. So, linear density means the mass per unit length or length per unit mass because there are two process one is a direct process of measurement, direct system which is expressed in terms of mass per unit length. And indirect system is that length unit mass. So, that this detail we will discuss and their interrelationship we will discuss. And

one important thing is that a particular material for a particular yarn we use a particular system.

There are systems like for filament, we use particular system measurement like a denier is a system we express for polyester or some any filament man-made filament but for cotton we use English count. Like for Oersted, we use metric count. Like that, so that, this we will discuss and their interrelationship we will discuss. Conversion of linear density of different systems, okay.

Then the linear density of folded and plied yarn, suppose we know the linear density of single yarn, what will be the linear density of plied yarn of different linear density? So this will discuss here and then methods of measurements. There are various methods of measurement of linear density of yarn.

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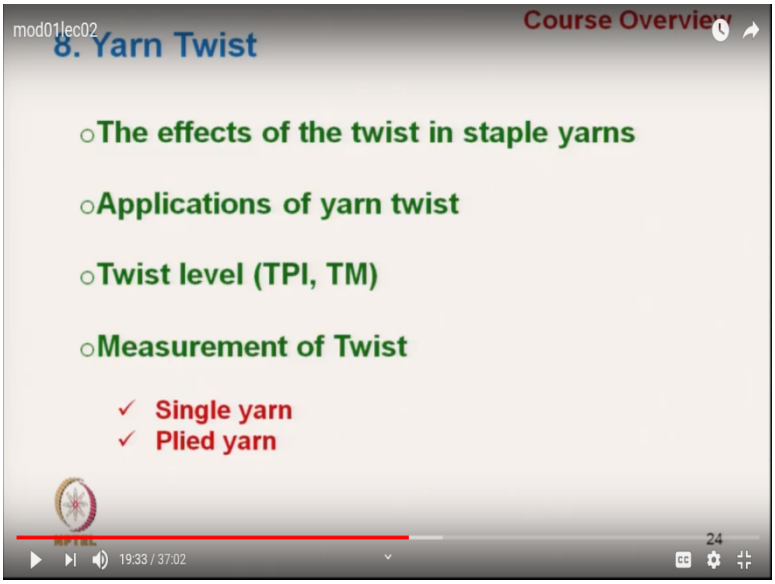

Then yarn twist which is very important for staple yarn. So first we will discuss the effect of yarn twist, in staple yarn, so first effect is the strength, strength changes with the twist of the yarn. Then application of yarn twist .So yarn twist we can use at different way different applications are there. Like if you want to produce Shadow effect we can go for different mix up of Z 2S dot, S twist. Okay. Different types of twist mixing we can do.

And what are the different twist levels. With twist is expressed in terms of twist per unit length, say twist per inch, twist per centimetre and what is a TM twist multiplier? So which is actually in directly so which is actually indirectly correlating is the twist angle. So this we

will discuss here. And measurement of Twist, so, there are various methods of measurement of twist this will discuss here. So for single yarn there are methods and for plied yarn. So these methods will discuss here.

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Then yarn and Fabric hairiness, so hairiness of yarn is most of the cases it is a undesirable. So we must know the level of hairiness so that we can take precaution. Okay so what is hairiness will try to see various causes of hairiness and problems what are the problems which creates created by hairiness and then will discuss the measurement techniques of the hairiness. So for yarn also and also for fabric and Fabric surface hairiness we will discuss.

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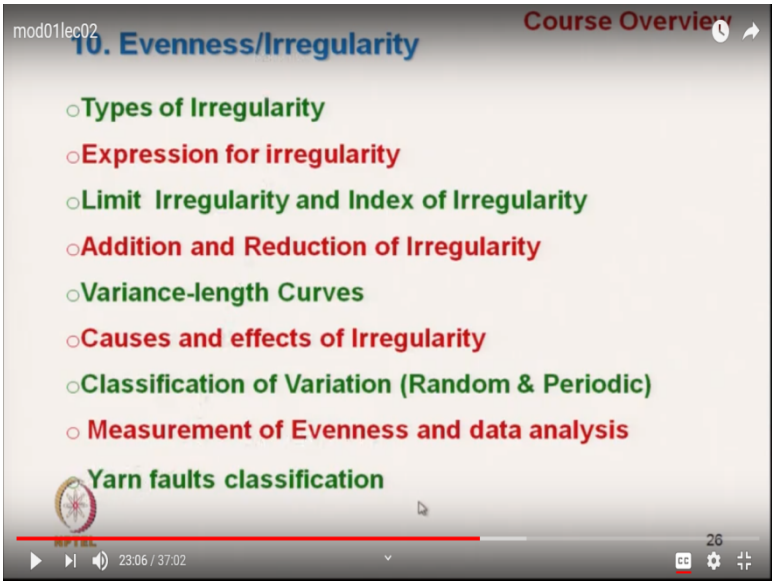

Next is that which is extremely important for appearance of material which is evenness or irregularity of yarn. Okay. So types of irregularity there are different types of irregularities

are there. That will discuss. Expression for irregularity like U %; U% is that which is percent mean deviation irregularity we can expressed in terms of coefficient of variation also.

This we will discuss here. Limit irregularity and index of irregularity which is extremely important to know that the index of irregularity means to compare the irregularity of two materials of different characteristics. Okay. This we can compare. And it indicates the performance of a particular machine, particular system. Then addition and reduction of irregularity, so how to increase the how irregularity is added or how irregularity is reduced.

This we will discuss. Typically if we stretch any material if we stretch any strand we add irregularity but if we double if we actually multiply if we actually use more than one strand. Then we are reducing the irregularity and we will see there are some equations how to calculate the addition and reduction of irregularity we will discuss. Then variance length curves we will discuss, Causes and effects of irregularities, Classification of variation random irregularity and periodic irregularity.

We will see the random irregularity is not that serious. The most critical irregularity is the periodic irregularity. Random irregularity gives the poorer performance but periodic irregularity which is not acceptable at all. This we will discuss how to identify the periodic irregularity the location of periodic irregularity due to fault in machinery part this will discuss here.

Then measurement of evenness and data analysis so that evenness measurement how to measure the evenness this will discuss here. And different data analysis of evenness okay and related to evenness and irregularity and another is that yarn fault. So it is a irregularity. It is different types of fault like long thick fault or long thin fault slabs this faults we how to classify this faults; this we will discuss in this segment okay.

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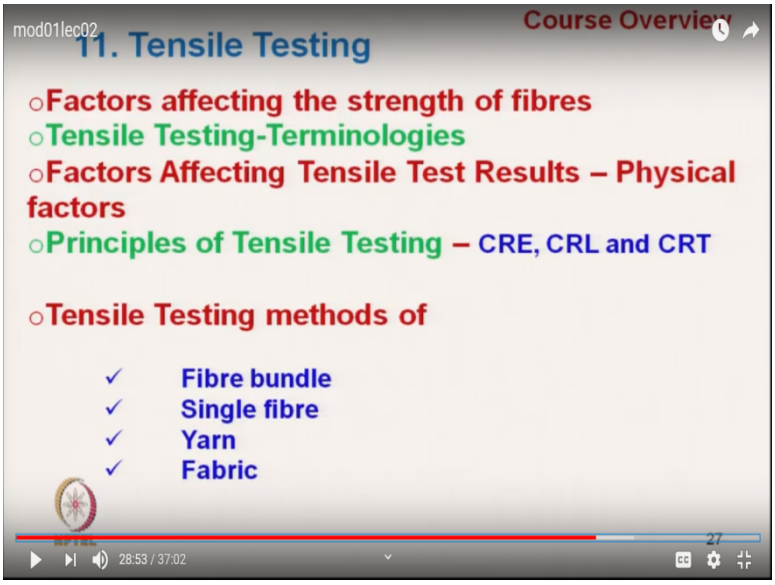

Next is the tensile testing of material okay, textile material. So tensile testing there are various factors which affect the strength of fibre. Then tensile testing terminologies, there are various terminologies like initial modulus, tenacity, breaking elongation. So all these terms we will discuss yield point. So this we will discuss and will try to clarify the doubts various confusions are there among the students.

So what is the how to convert the load elongation curve to S strength curve. So, these things we will discuss here. Then factors affecting the test result, Tensile test result. Okay. So physical factors we will discuss here. Like factors affecting if it is as we have discussed earlier that the length of the material guess length of the material it affects. Speed of test so this affect the test result. Okay. For a particular material and related calculation will do.

And then tensile testing instruments are divided into three categories based on the principle of this testing. One is called CRE constant rate of elongation and another is CRL constant rate of loading and third one is CRT constant rate of traverse. Now the confusion comes between constant rate of elongation and constant rate of traverse. I am trying to test the tensile testing. So my left hand is it is a fix jaw. Okay. And here it is a right hand this is a moving jaw.

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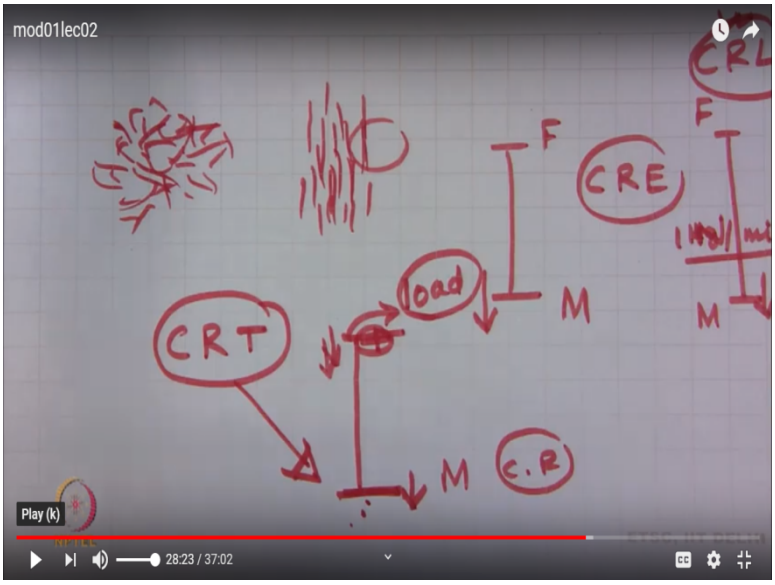

Let me draw here this is the fix jaw. Okay here it is this one is the moving jaw. And if this moving jaw moves at a constant rate that means elongation will be at constant rate. So this is will be a constant rate of elongation. Now next is that this fixed jaw. This is a moving jaw. Okay. This jaw is moving in such a fashion that loading on the yarn is at the same rate, loading on the yarn increases at the same rate. Okay. Suppose 1 kg per minute okay.

Say one whatever one centi Newton one Newton per minute. At that rate the testing is taking place. The loading is increasing. So it is a fixed, so, then will call it as CRL constant rate of loading. So the instruments are there which will ensure the increase in load at constant rate. Okay. But what about the constant rate of Traverse. Here the thing is that this one is movable jaw. Okay. This one is movable jaw.

But the other jaw is not fixed. Here this jaw also moves to measure to actually excite to send signal to the load measuring system. This jaw is moving at a constant rate. This that bottom Jaw is moving at constant rate. Top Jaw is not fixed. Top jaw also moves, but not at this rate, at the rate of bottom jaw. That means it is neither CRE nor the CRL. So that is why this method is termed as sea CRL, CRT due to the fact that this bottom Jaw is traversing at constant rate.

Okay. And this detailed method we will discuss in during the course. Okay. And next is that tensile testing methods. Different testing methods we will discuss. We will start with the fibre bundle testing then single fibre testing. Then yarn tensile testing and Fabric tensile testing, they have their various standard methods are there. We will discuss in detail

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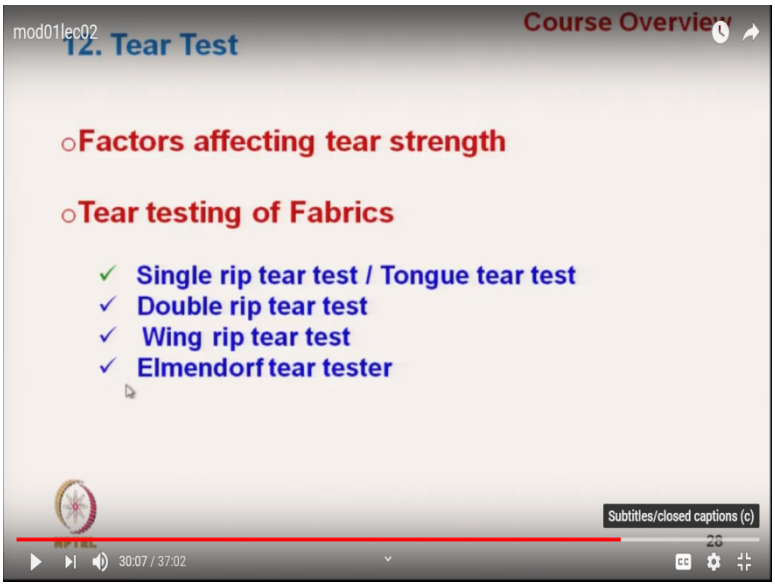

Next, comes the serviceability test. Okay. It takes care of the tearing testing, busting testing okay, and rubbing testing okay. So this is actually these are related to serviceability testing use. We actually the fabric counteract all these types of issues. These are not a regular testing okay. Like tear testing, tearing only occurs occasionally. Okay. When there is some sharp object comes into and also some hoops are there. Okay.

So, that is why these are serviceability testing, we will start with the various factors which affects the tear testing. Then tear testing of obviously it fabrics we are talking about here. There are different types of testing. It is a single rip tear testing is known as tongue tear testing. So, we will discuss this. Then double rip tear testing, wing rip tear testing and element of rip tear testing.

Okay various rip tear testing we will discuss. And first three testing single rip, double rip, and wing rip tear testing it requires the tensile testing instrument. And that is why this instrument the three methods they follow CRE principle. If it is asked among this which is which are the methods which follow these CRE principle, these three methods they follow the CRE principle. Constant rate of elongation principle but element of testing it follows the; it is a sudden impact pendulum principle. It is Okay.

It measures the tearing energy this will discuss here. Then comes under the serviceability testing and it is a busting.

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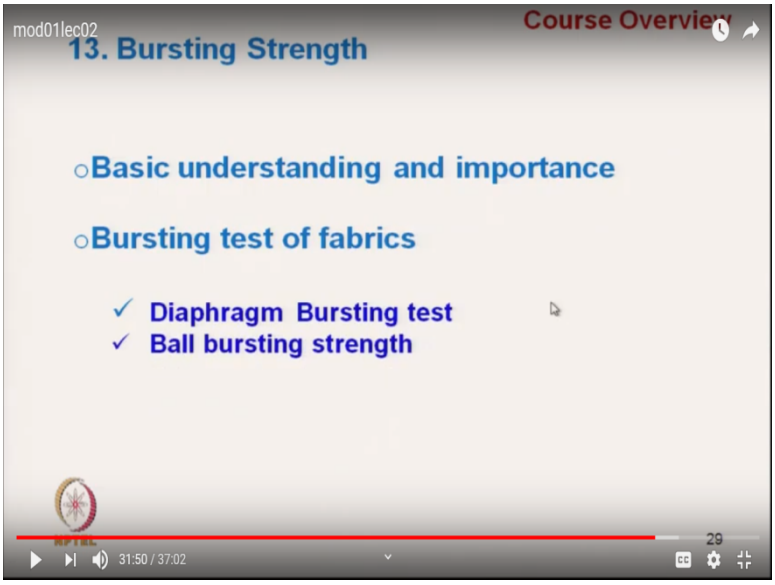

Busting is also not normally not common testing. It is for a specific application we test. And there are various technical textile where busting is extremely important. Like parachute fabric or filter fabric where we need to test busting. Normally we do not test busting for apparel fabric. But for technical fabric it is required. Busting like for geotextile busting system is important .Where the direction of force is not unidirectional.

It is a multidirectional force application. So we have to understand the basic understanding of busting strength and their importance. We will discuss first. Then busting strength of fabric measurement we will discuss. Then diaphragm type of extinction ball busting strength. Okay.

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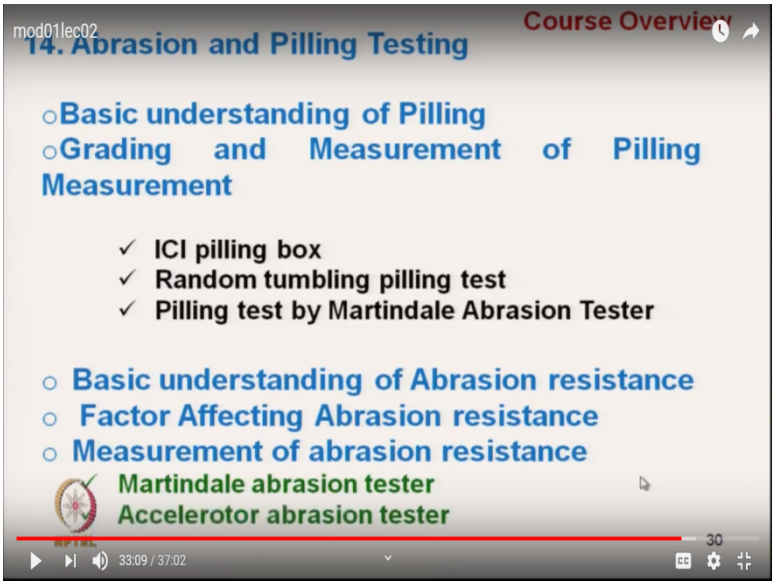

Then abrasion and pilling, so, during application, during service, the fabric gets separated, It is not required for during production. But during application it gets upgraded. So abrasion testing is required for basic understanding of a pilling and what is pilling will? How pilling forms? This we will discuss here and grading and measurement of pilling. So, how to grade the pilling? That we will discuss.

And ICI peeling box the random tumbling pilling test is there. Then pilling test by Martindale Abrasion Tester and this we will discuss and basic understanding of abrasion. So pilling and abrasion they are interrelated. But abrasion is something else basically which abridge the fabric it may or may not generate the pilling. But it actually deteriorates the quality of fabric where factors affecting the Abrasion resistance.

So for instrument if we measure there are factors, if we change the factor that you will get a different abrasion result. Okay. And Measurement abrasion resistance that we will discuss, Martindale Abrasion Tester is there. Accelerator Abrasion Tester is there.

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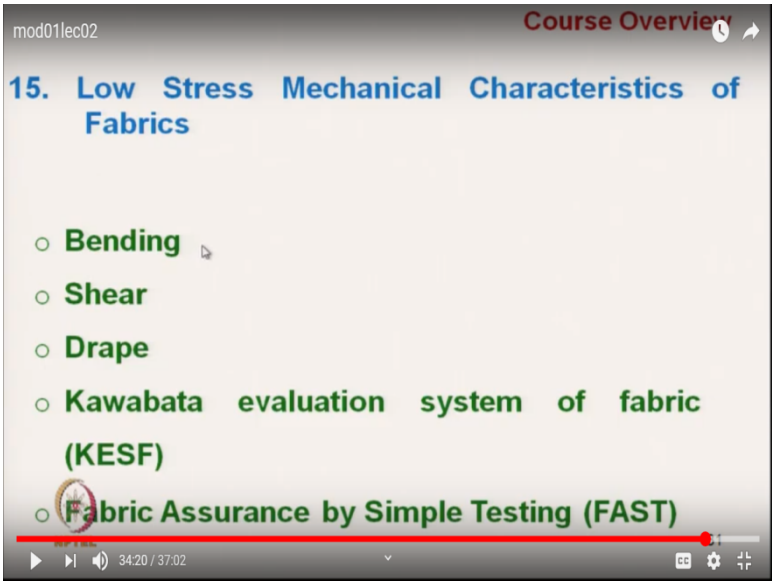

So this we will discuss. Next comes to the low stress mechanical characteristics of fabric, which is related with fabric handle, where we apply low stress. It is not high stress. We are not going to go up to the breaking point. Okay. So low stress mechanical characteristics it talks about the bending. So bending of fabric we will measure, will understand and then shear characteristics of fabric. These are all low stress characteristics.

Then drape characteristics we will measure drape Coefficient, will try to measure and then will discuss in detail. KESF method, kawabata evaluation system of fabric KESF which deals with all the low stress mechanical characteristics. Another other low stress mechanical characteristics instrument is the FAST like bending. We will discuss the different types of bending cantilever bending, the loop type bending. So all this bending we will discuss here okay.

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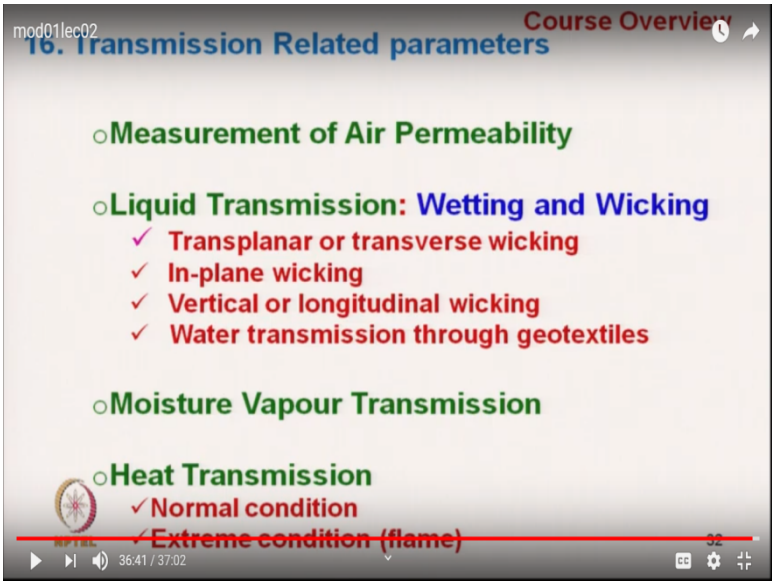

And next is that the transmission characteristics of textile material. A transmission characteristic starts with the air permeability. So basically any fluid transmission through material will discuss measurement of air permeability. We will discuss here then liquid transmission. So wetting and wicking. So absorption of liquid and transmission of liquid wicking characteristics we will discuss here.

Then transplanner wicking or transverse wicking that is it is across the plane across the thickness of the fabric how the, at what rate the liquid transmit is that we will discuss here. Then in plane along the plane the liquid transmission characteristics we will discuss, then vertical or longitudinal wicking characteristics, then water transmission through geotextile that is the transmission characteristics of water through geotextile.

There are methods for measurement we will discuss here. Then moisture vapours transmission through material. So there are various methods of measurement of moisture vapour, I am not going in detail so that we will discuss the moisture vapour transmission there. Cop methods that they are like sweating guarded hot plate method is there. All these

methods will discuss then heat transmission. So heat transmission is guarded hot plate method is there. Then tug metre is there. So heat transmission measurement of heat transmission through textile material we will discuss. So this is overall the total outline of the course overview of the course. So from next class, we will start to the actual course, actual test methods and we will start with the statistical or sampling method okay.

There is normal condition method. It is the normal heat transmission at normal room temperature and extreme conditions in flame condition how to how the heat is getting transmitted, okay and that is all thank you.