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Geotechnical Engineering Laboratory

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Lecture No -01

Soil Processing

I will teach the geotechnical engineering laboratory the different types of the soil testing and this is very important because most of the structure waste on the art, so it is very important to know the characteristics of the soil and rock without proper testing if anybody wants to construct any kind of the infrastructure then there will be a disaster and there will be great problem to the society and also to the engineer, so it is very important to know the open kind of the testing of the soil as you know that soil is a heterogeneous material.

So testing characteristics is not the same as you like a concert so it varies it testing characteristic so we will deal that different types of the testing in geotechnical engineering laboratory and how to perform the different types of the test how to evaluate the properties of the soil materials.

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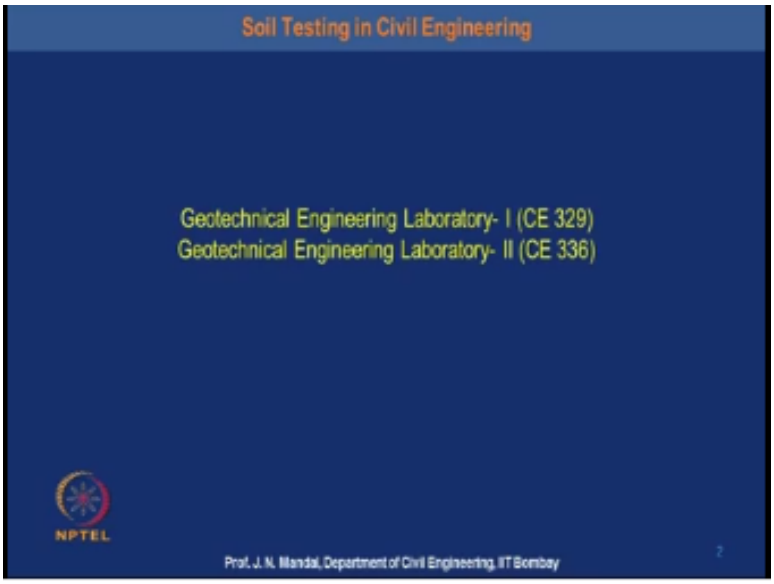

So we have give the two course in that is geotechnical engineering laboratory that is I and geotechnical engineering laboratory II so these are the two courses are generally we will open and we will talk about these few courses different types of the testing. Now what we wanted to focus here that what kind of middle one that first we can talk about that soil procession.

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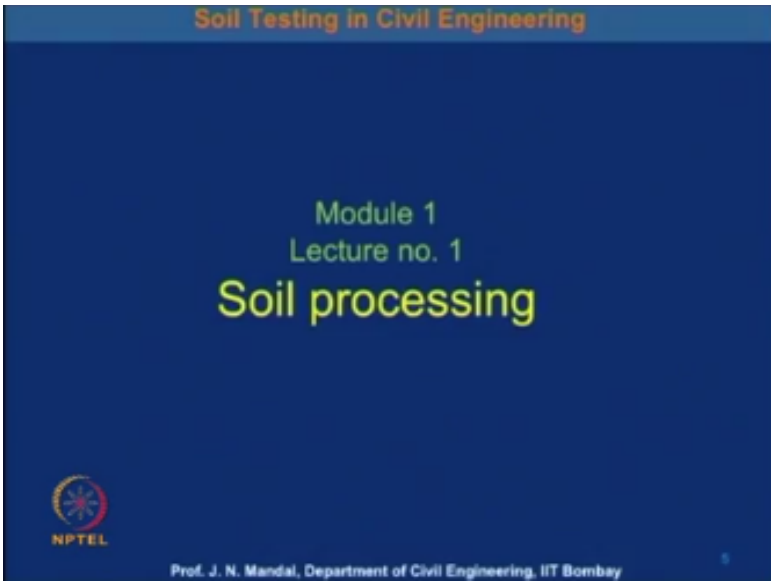

So how to process the soil this is primarily very important for any kind of the soil testing.

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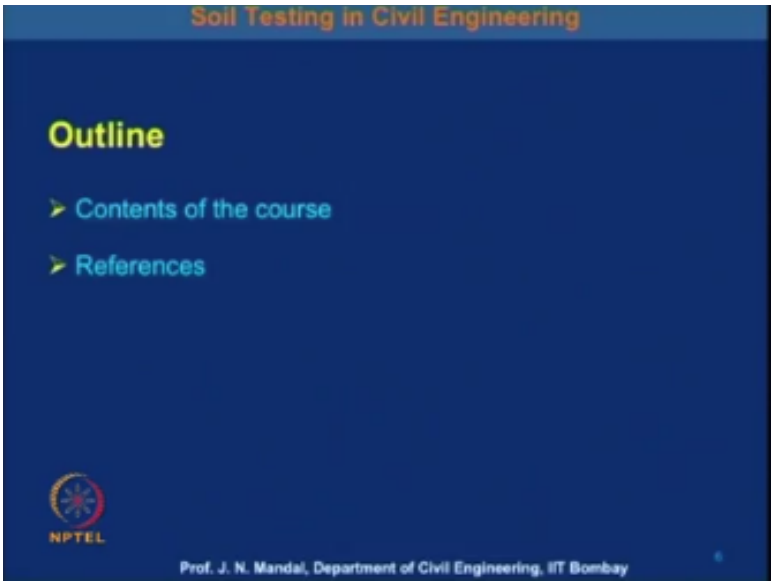

So outline of this I just discussed about the content of the course and some of the references which you can go through this, courses and this references which will be helpful to you this geotechnical engineering laboratory will.

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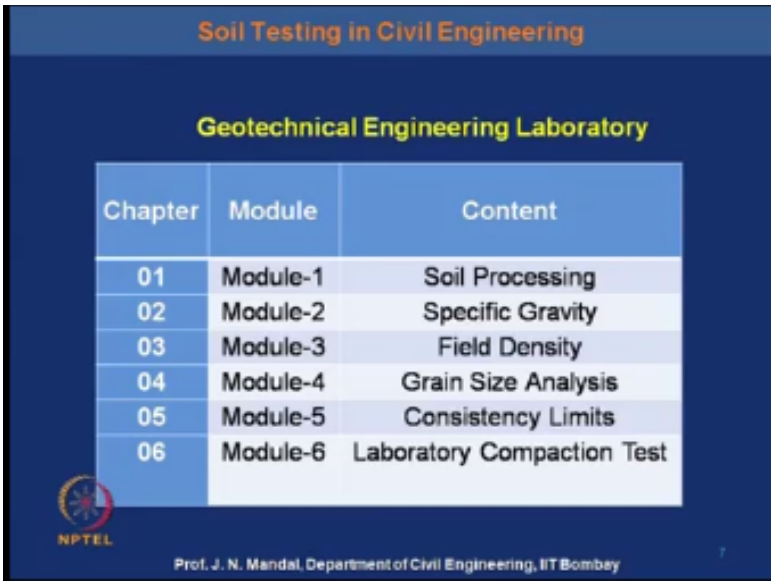

Cover that module 1 that is content soil processing, and module 2 a specific gravity of the soil, module 3 the field density, module 4 grain size analysis and module 5 consistency limits of soil and module 6 laboratory compaction test.

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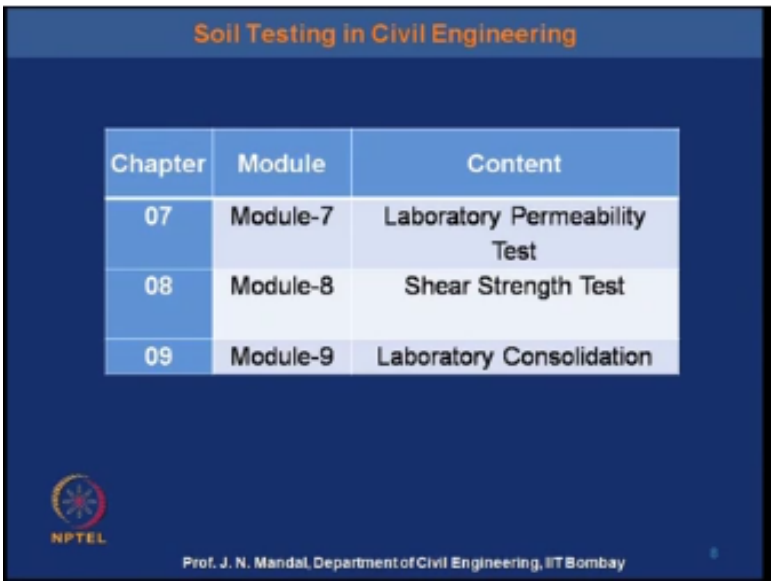

Now module 7 laboratory permeability test, module 8 Shear strength test, module 9 laboratory consolidation test so we will cover all this lecture, so what are the target audience for this course, so this course will be very much useful.

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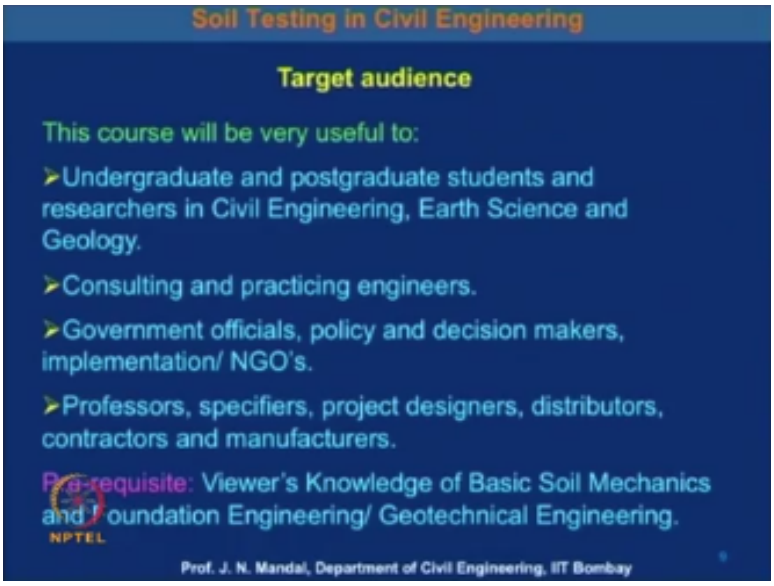

To undergraduate and post graduate student and researcher in Civil engineering art science geology and geotechnical engineering consulting or practicing engineers government official policy decision maker and implementation or NGO's professor, specifies, project designer, distributors, contractor and manufactures. And what course that requirement prerequisite is we are knowledge about the basic soil mechanics and foundation engineering or geotechnical engineering.

So once you know the this pre requisite courses then it will be very much helpful then you will be knowing how to platform the different types of the soil testing and that is being some of the reference.

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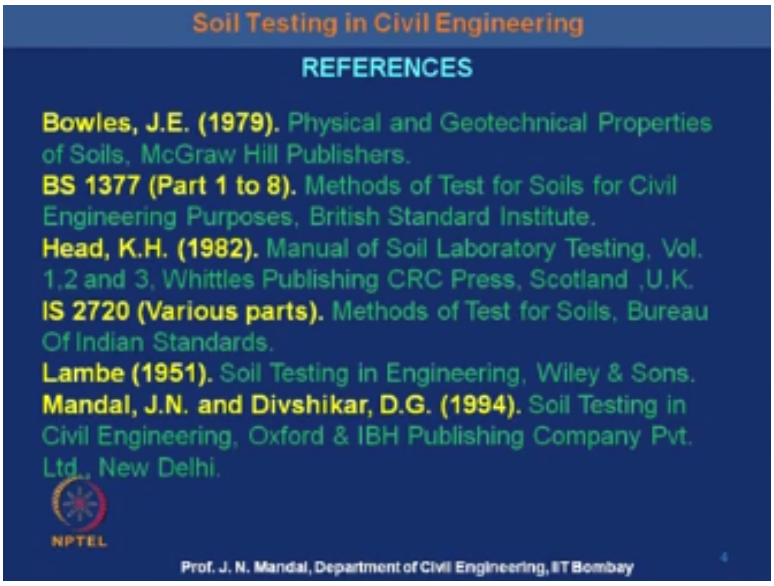

You can go through this references this will be very much helpful to you so this is the author Bowles, J.E 1979 the physical and geotechnical properties of soil this is McGraw Hill Publisher there is a code specification BS 137 part 1 to 8 method of test for soil for civil engineering across that is British standard institute then head, K.H 1982 the manual of soil laboratory testing and IS 2720 various parts the method of test for soil that is Bureau of Indian standard.

There is a book also Lambe 1951 soil testing in civil engineering Wiley and Sons apart from that you can go through the books Mandal J.N and Divshikar D.G 1994 spoil testing in civil engineering oxford and IBH publishing company private limited New Delhi.

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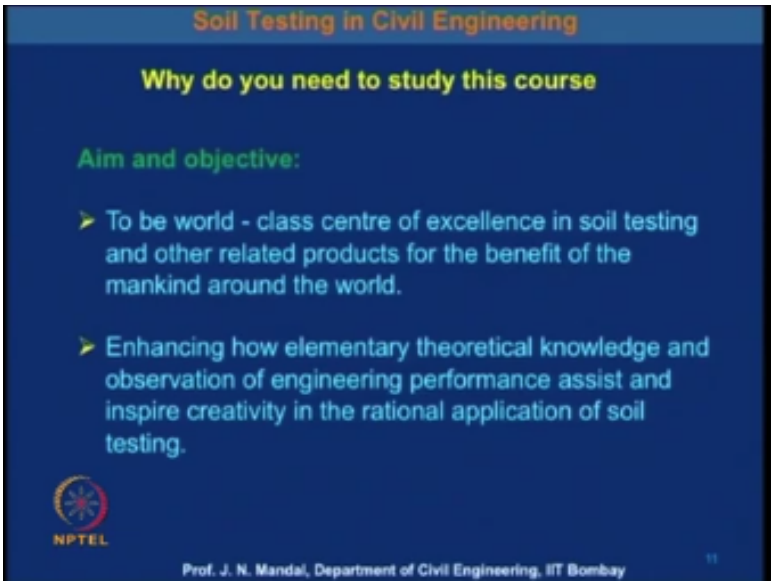

So one can go through this reference so why do you need to study this course our aim and objective to be world class center for excellence in soil testing and other related product for the benefit of the mankind around the world enhance seeing how elementary theoretical knowledge and observation of engineering performance assist and inspire creativity in the rational application of soil testing so with this aim and objective.

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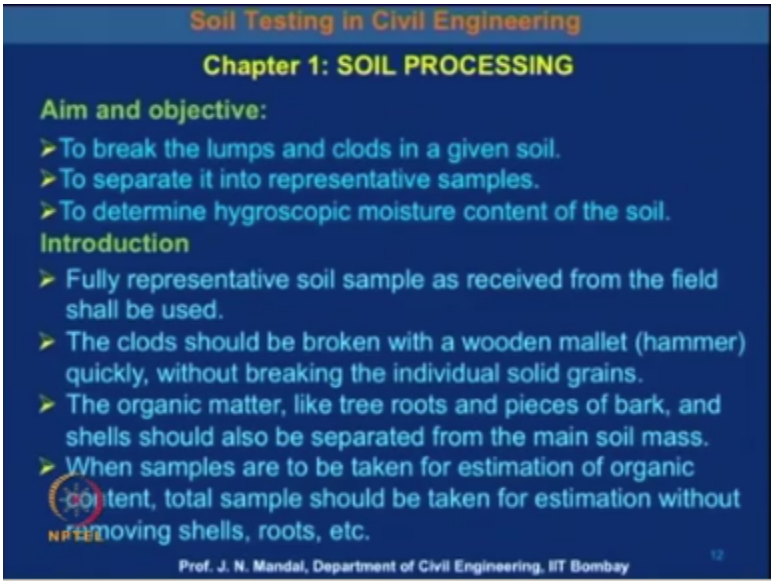

We can start the chapter 1 that is soil process so this is very important how to proceed the soil and for these aim and objective is first a fall that here to collect the soil and they here to break the lump and clods in a given soil then you separate it into the representative sample to determine hygroscopic moisture contain of the soil so with this same an objective we go through the introduction this is fully representative soil sample as received on the field shall be used the clods should be broken.

With the wooden mallet that is hammer quickly without breaking the individual solid grains the organic matter like tree roots or pieces of bark and the shell should also be separated from the main soil mass, when sample are to be taken for estimation of the organic content total sample should be taken for estimation without removing the shell roots etc. Whatever it contain so one has to be careful about who the how to process the soil.

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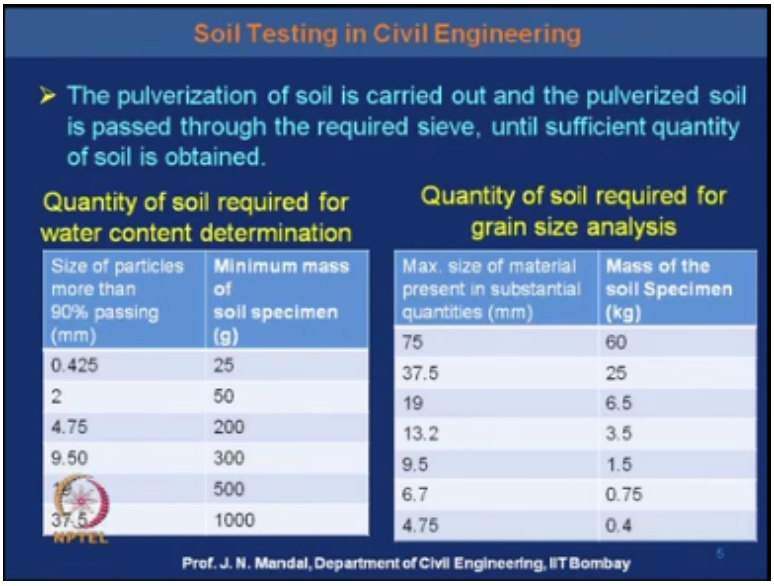

Now the pulverization of the soil is carried out and the pulverized soil is passed through the required sieve until sufficient quantity of soil is obtained. So here the number of the seed this is size of the particle more than passing through 90% pulse and these are the sizes that is 0.475 to 0.475 9.5 19 and 37.5 this is quantity of the soil require or water quantity of soil require for grain compact determination so this is the size of the maximum the size of the material and present in the season can see here that minimum mass of the soil specimen juts 25 50 200 300 when it passing through these seeds.

This 500 and the 1000 similarly maximum size of the material present in the substantial quantity that is again 75, 47.519, 13.2, 9.5, 6.7 and 4.75 and mass of the soil is it a 60, 25, 6.5, 3.5, 1.5, 0.78 and 0.4 in quantity of the soil and this reduction require or the various level strategy so we require that what should be the specimen gravity that is fine grain soil then what is the amount of soil we call and then passing through higher size so for the specific gravity find here we required.

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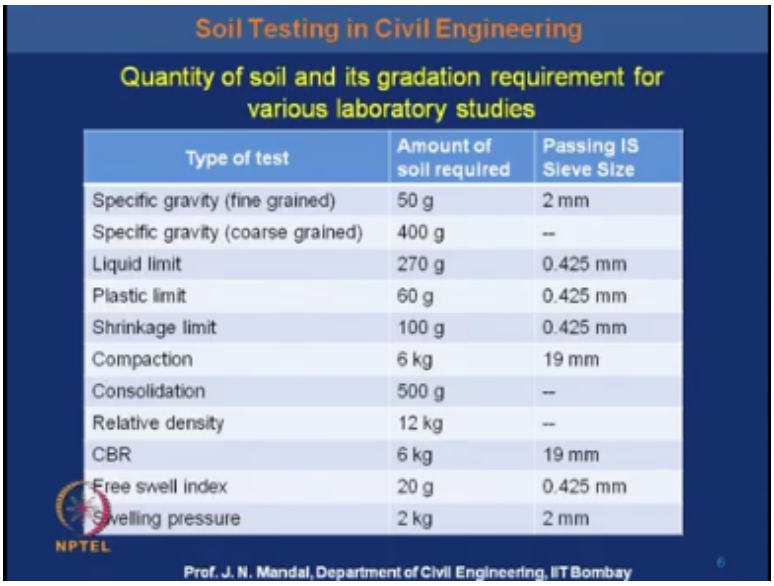

50g and passing through the percentage is to mm specific gravity of coarse grained that amount of soil we call about 400g liquid limit we require 270g and passing of about 0.425mm for plastic limit we require 60g and then it pass through 0.452mm in case the limit is require amount of soil about 100g and it is passing through 0.452mm for compaction we need 6kg o soil and it is pass to 19mm consolidation 500g relative density 12kg CBR that is California bearing ratio we regards 6kg and passing through the swell box 19mm.

Free swell index is required 20g and passing through their seed 0.425mm swelling pressure we required 2kg and passing of seed about 2mm so once you know the idea about how much quantity of the soil require or the specific different kinds of the testing and what should be the pushing of the seed size so that once we know initially or any kind of the soil testing so from the soil testing we require some equipment and the accessory.

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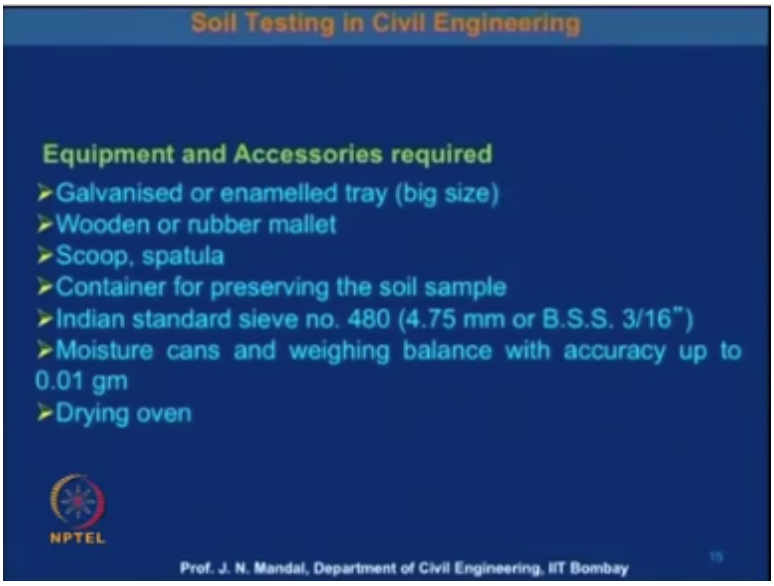

So we record that galvanized or enameled tray will be bigger size we need the wooden or rubber mallet he records scoop, spatula container for preserving the soil sample then also yet to follow up the Indian standard sieve no.434.7mm or B.S 3/16" in moisture can weighting balance with accuracy up to 0.01g and the drying oven so these are the equipment accessory are required for soil testing I will show you see some of the recommend and the accessory by next slides so this.

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The equipment are required this is the scoop and this is the we can say wooden mallet is here this is the soil sample inside this container and this use this container we fill up with the soil and also we determine what will be the wet weight of the soil what will be the dry weight of the soil and this is the oven which we can keep this container into the oven for the drying at a particular temperature and that particular time in order the soil can be dry.

And then you can determine what will be the weight of the soil and what will be the weight of the dry soil and also you can determine that what will be the measure contain of the soil, this is the oven dried sample and this is the spatula and this is the tray. So these are the equipment generally we use for this soil testing. So we next we will go for the procedure.

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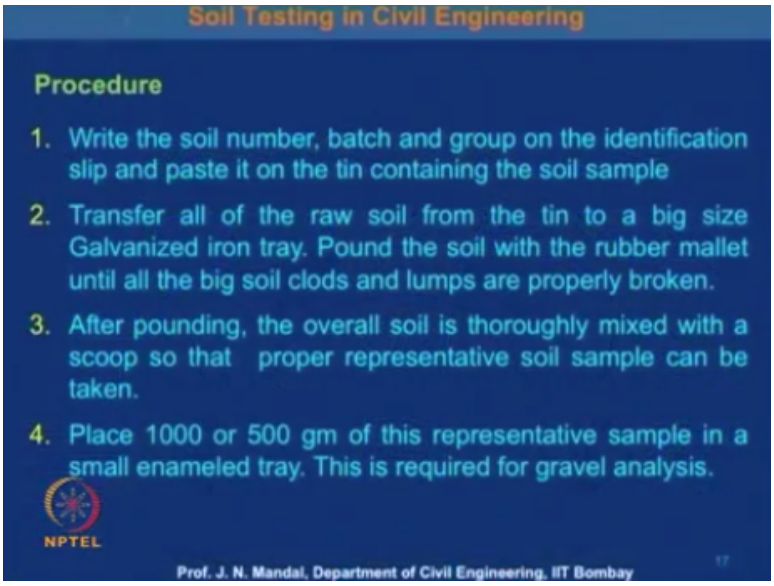

So write the soil number whatever the soil you collected so you should know that what kind of the soil what will be their number, what will be the batch and the group on the identification slip and paste it on the tin containing the soil sample. Then transfer all the raw soil from the tin to a big size galvanized iron tray and pound the soil with the rubber mallet until all the big soil clods and lumps are properly broken.

After pounding the overall soil is thoroughly mixed with a scoop so that proper representative soil sample can be taken. Place 1000 or 500 gram of the representative sample in a small enameled tray and this is required for the gravel analysis, so whatever the amount would not at the end it will be that you have to collect and then that will be required for their gravel analysis.

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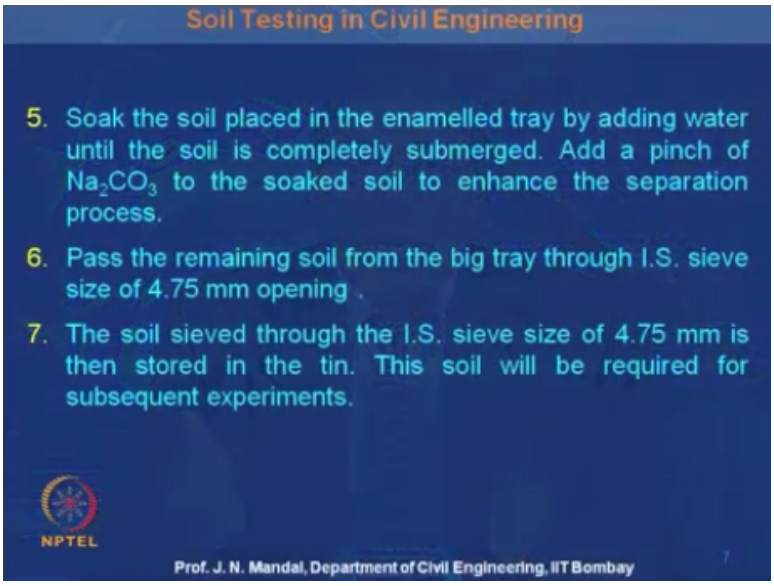

Soak the soil placed in the enameled tray by adding the water until the soil is completely submerged. Add a pinch of sodium carbonate to the soaked soil to enhance the separation process, so the soil should not be collapse so which could be separated so you can add certain amount of the sodium carbonate into the soil. Pass the remaining soil from the big tray through the IS number 480 or 4.75mm diameter opening.

The soil sieved through the IS sieve number 480 is then stored in the tin. The soil will be required for the subsequent experiments. So next we will determination of the moisture and contain of the soil or the hygroscopic moisture content, so for any kind of the testing of the soil initially you should know that what should be the hygroscopic moisture content in the soil and how to determine the moisture contain.

Because moisture contain baddy to place to place soil to soil so this is very important to determine the moisture contain of the soil and I will focus how you can determine the moisture contain of the soil.

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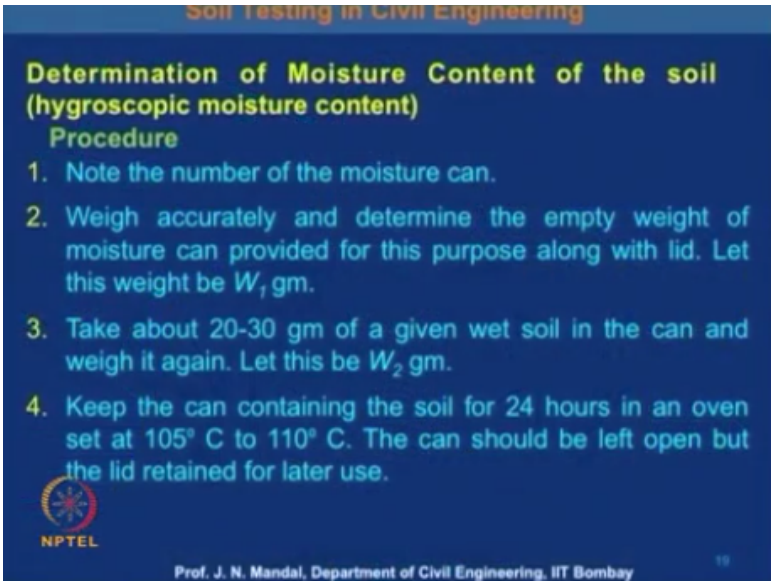

So this procedure is first of all, note the number of the moisture can which we have to keep the soil. Second you weight accurately and determine the empty weight of the moisture can provide it for the purpose along with the lid. Let this weight be W_1 gram. Thirdly take about 20 to 30 gram of the given wet soil in the can and weight it again and let this weight be W_2 gram. Then keep the can containing the soil for 24 hours in an oven set at 105ºC to 110ºC and this can should be left open but the lid retained for the later use.

So you should know that how you can take and put the soil into the container and how you can put it into the oven for drying at a particular temperature of 105 and 110º for the 24 hours. Now the entire soil will be the dry. And then after completion of the drying cool the container in a desiccators to room temperature then weight it.

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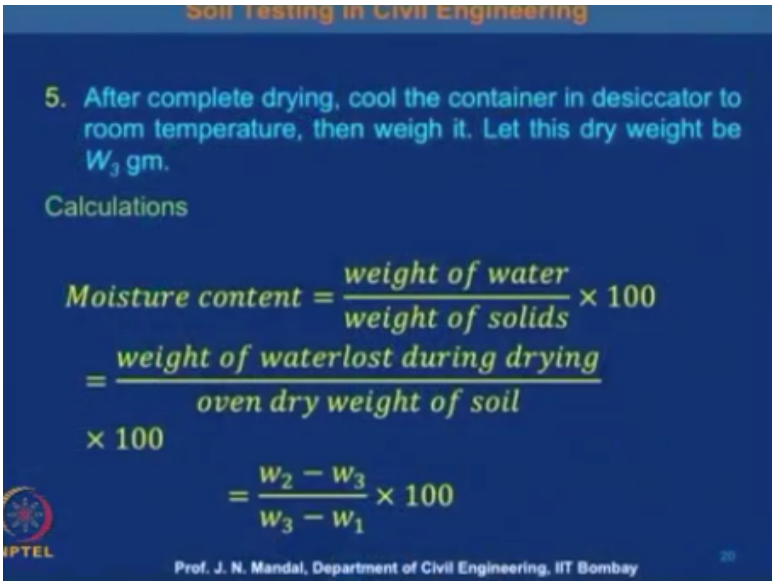

Let this dry weight be W_3 gram, now knowing all these data now you can determine what should be the moisture content of the soil, so the definition of the moisture content of the soil the ratio of weight of water and the weight of solid into 100 because this in terms of the percentage. So whatever the weight of water loss during the drying and that divided by oven dry weight of the soil into 100.

You see that in the beginning that this weight is the w2 this is w2 and this is weight of wet soil then this w3 dry soil then it will dry soil while w on the weight of the container so you can divide w2-w3/w3-w1x100 which will give you that what will be the moisture content of the solid. So this is I am giving some specimen calculation or hygroscopic moisture content.

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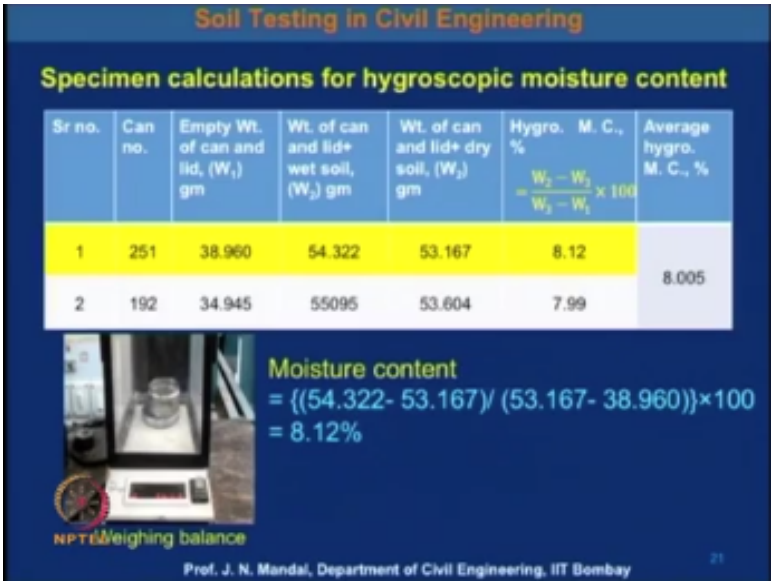

So one should know as I told you that what will be the can number so you can go further 4 5 6 of this kind of the test and you take the average and you determine what will be the average hygroscopic moisture content of this solid. I am just showing one of the serial number that if the can number is 251 which you are to be pasted in the can you remember that this can number 251 then you take the empty wait okay of the can and the lid which is this w1 gram that is 38.69.

And then you take wait of the can and the wait and the wet soil that is w2 gram that is 54.322 and wait of the can and the lid and the dry soil that w2 gram that is53.167. So knowing this value w1 w2 and w3 so you can determine what should be the hygroscopic moisture content. That means this is the equation from this equation you can determine and this value is coming 8.12 and you take the average like that 456 in one w1w2w3 calculate that Can and the different wait and they need calculate what will be the hygroscopic moisture content.

And then you take the average of this here average about 8.005 and how to calculate I mentioning easier moisture content this 54.322 – this 53.167 / 53.167 – 38.950 x 100 that is why 8.12% of hygroscopic moisture content of the solid and this is the waiting balance in which you can measure the dry soil also the wet soil. So this kind of the equipment we generally use so now you understand that how to calculate the hygroscopic moisture content of the solid. And this is the specimen calculation for different soil or the field moisture content.

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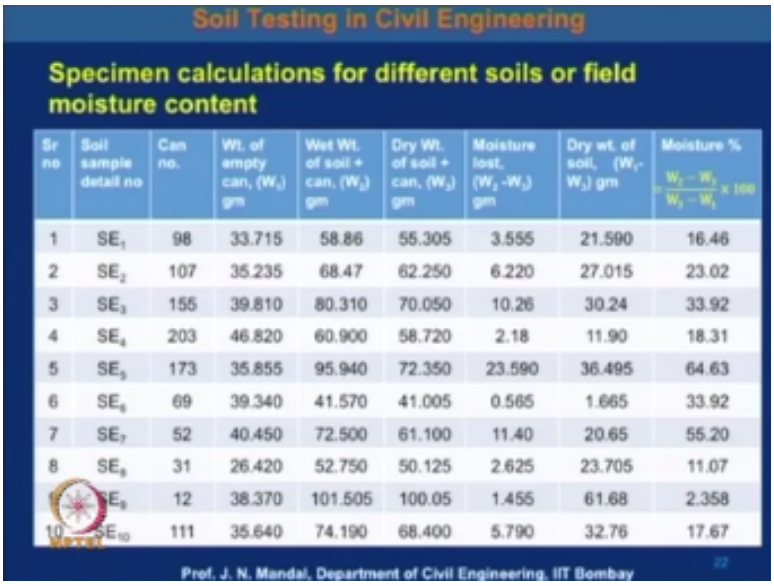

So same you can go through the different type of the soil can and there you define wait and then you calculate the moisture content is being determine and given here.

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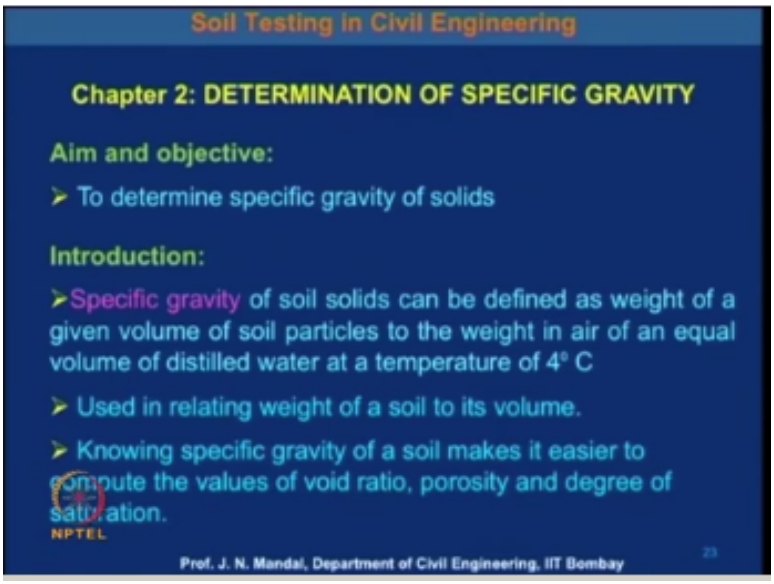

Next we have to determine specific gravity of the soil, so you know that how to determine the hygroscopic moisture content of the soil now we will determine the specific gravity of the soil and moisture content is very important you know for any structure contraction you should know that what will be the moisture content of the soil on the sight.

Next that determination of the specific gravity the aim and objective to determine the specific gravity of the soil, so specific gravity of the soil solid can be defined as weight of the given volume of soil particle to the weight in the air of an equal volume of distilled water at a temperature of 4^0C. So use in a retaining weight of soil to its volume knowing the specific gravity of the soil makes easier to compute the value of void ratio, porosity and the degree of saturations.

So if you determine the specific gravity of the soil from the specific gravity of the soil this is very important parameter then equally you can determine that what should be the void ratio of this soil what should be the porosity of the soil and what will be the degree of saturation of the soil, knowing the value of the specific gravity of the soil. So specific gravity also is very important.

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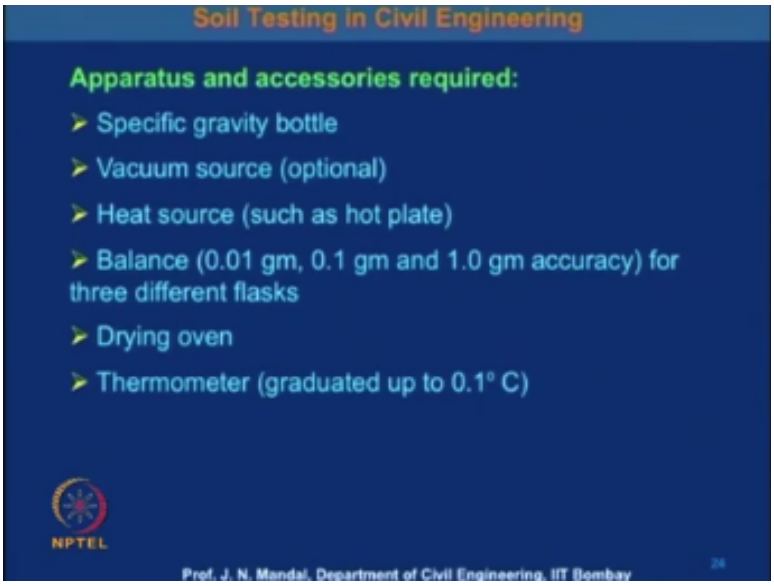

What determination or also other parameter so for the determination of specific gravity we required certain operators and the assessor required. So first we required the what will be the specific gravity bottle, then vacuums source that is optional heat source such as hot plate it require balance 0.01gm to 0.1 gm and 1.0 gm accuracy for three different flasks, drying oven and the thermometer that is graduated up to 0.1^0C. So these are the type of thermometers what is equal for the specific affinity what is the this is the 18 balance specific gravity .

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In which we can determine the specific solid and we have to intake the temperature is required also the thermometer you can also obtain the temperature.

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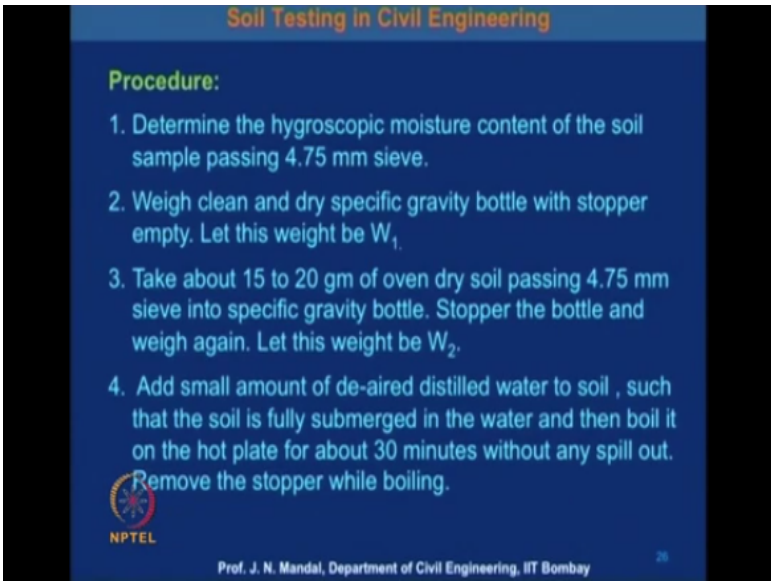

So procedure for the specific gadget is first off we know that determine the contain of the soil sample passing through food pint centimeter that is the white clean value specifies gravity bottle with the stop oil and let as this take about the 15 to gram of soil passing the 4.7 millimeter seed in to the specifies gravity bottle and stop the bottle and quite again the with the male amour of Gr this will retain the soil that soil is fully much in the water an d then boil it and the hot flame for above 40 min without any sellout remove e the stop oil boiling cool the bottle to the room temperature till it completely with the d kilo water.

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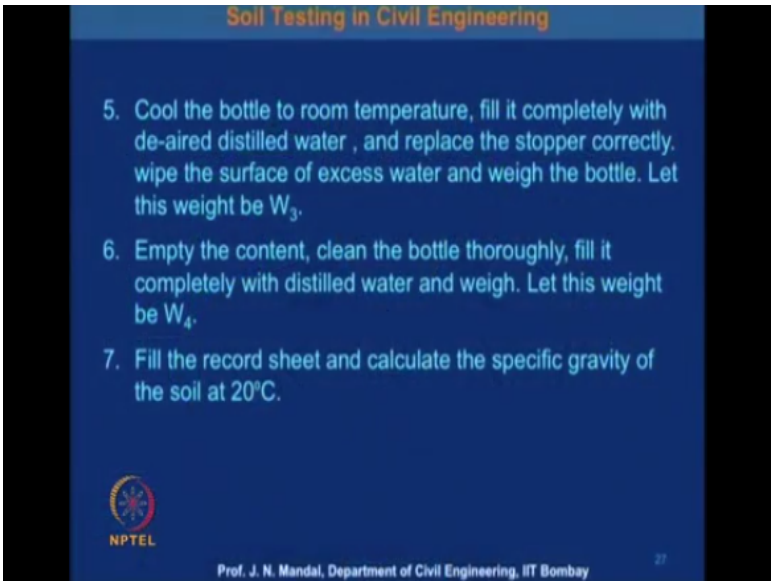

And replace the stopper correctly and wipe the surface exercise what are wait the bottle the weightW4 of the bottle in the t is something in the bottle clean and thoroughly heal it with the completely the distilled watered quite the wipe the then clean the record seed t o calculate the sepsis gravity of the boil latte temperature at20^0 centigrade so third these specifies gravity we are see them.

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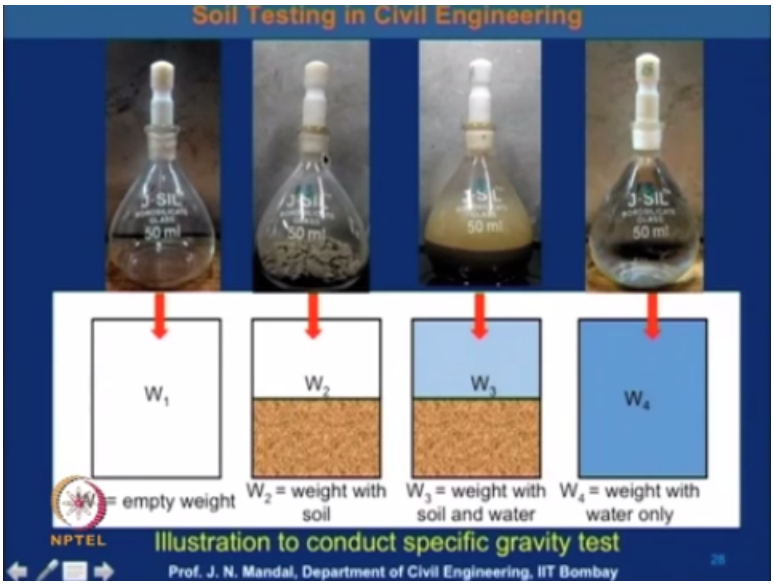

At his is w3 with the soil and the water and then the weight with the water only so this is just I showed in the instruction you can know the specific and the gravity of the other soil so you have to calculate the specific of the gravity for the soil is species w1 /w4 so this is the meaning for the heat can be the major and also the w so the w2-w1 is the weight of the specific gravity is equal to the ace / w5w4w3 main these are the data so we can remain the sp hectic gravity of the soil with this I finished the lecture ok thank you.

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