Soil and Water Conservation Engineering
Prof. Damodar R. Mailapalli
Department of Agricultural and Food Engineering
Indian Institute of Technology, Kharagpur

Lecture – 56
Sediment Sampling

So, this is a lecture number 4 of week 12. So, mostly in this lecture we will be talking about Sediment Sampling. So, the previous lecture we were talking about sediment transportation. So, once you have sediments in the river or any water body, so, how to sample that so, that we will be discussing here.

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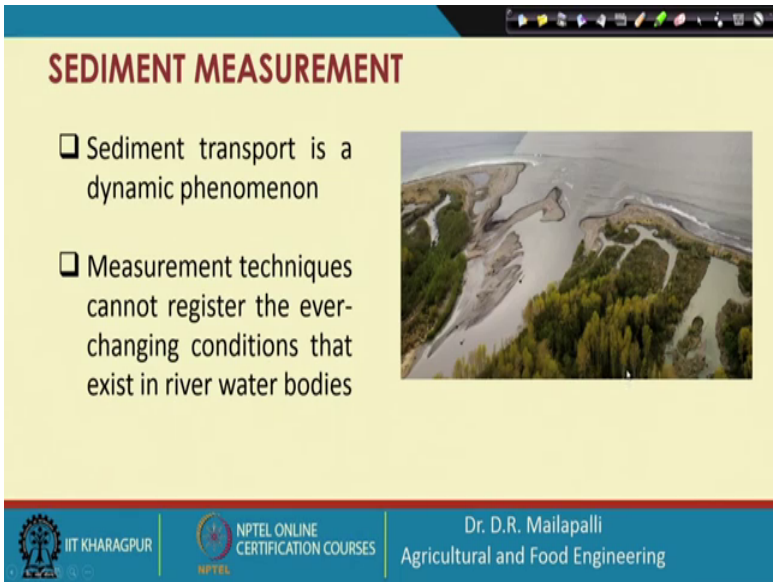

And, then so, the sediment measurement so, sediment transport is a dynamic phenomenon. So, because it changes with time and also it changes with space. So, it is a dynamic. So, you may not be so, suppose you have collected the sample today so, the concentration of sediment it may not be same as tomorrow or it may not be or yesterday. So, it may not be same as location 1 and location 2.

So, the measurement techniques cannot be registered the ever changing conditions that exist in river bodies. So, measurements techniques we will vary I mean different measurement techniques. So, one single measurement technique may not be enough to tackle these dynamics of sediment dynamics, ok. So, let us see some of the you know the devices we will be using to measure.

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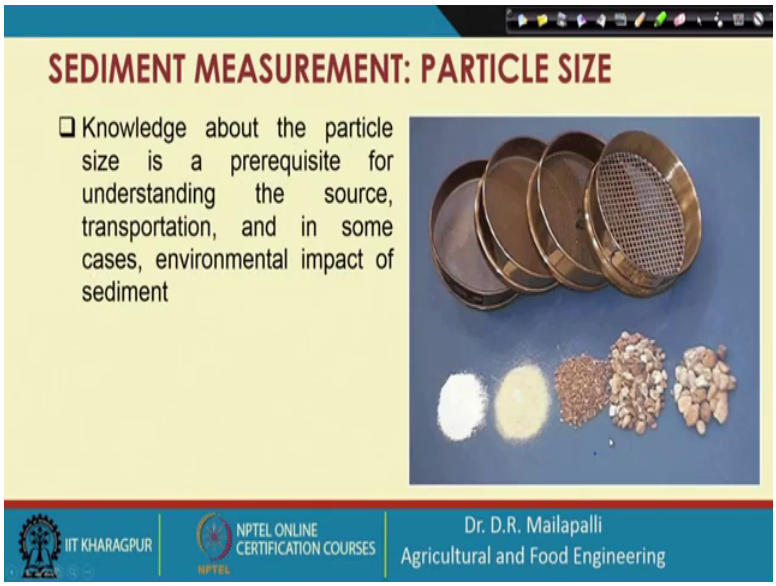

So, before measuring you know sediment load so, if you see the over the particle size is very important. The particle size is generally measured or particle size is estimated using sieve analysis. So, the knowledge about particle size is prerequisite for understanding the source, transportation and some cases environmental impact of the sediments. So, knowing this segment size it is very important. So, what is the source and where exactly the sediment has come from. So, basically here we will be using set of sieves in ascending order let us see.

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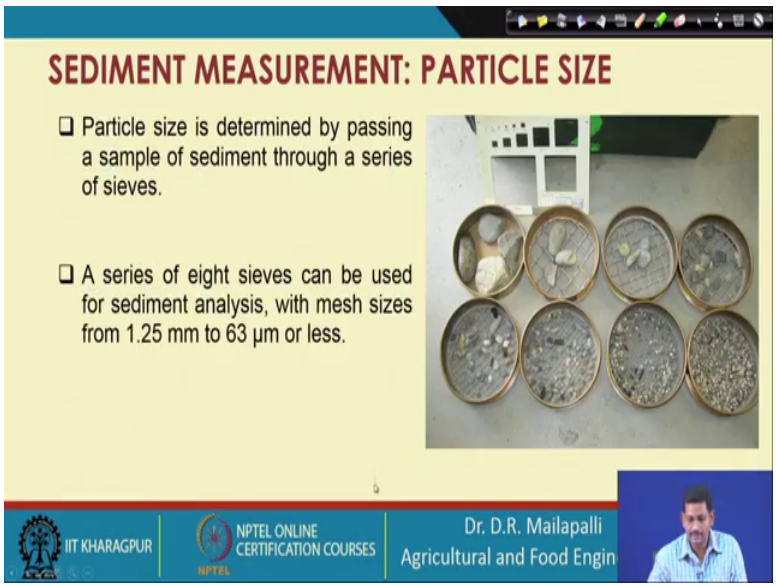

So, if you see the sediment the particle size is determined basically passing a simple sample of sediment through a series of sieves. So, the mesh sizes could range from 1.25 mm to 63 microns or less. So, 63 microns we have seen it is less than if this is less than and as will be silt and clay. So, mostly we are talking of the sand here. So, series of sieves; so, here I mean sieve number 1, sieve number 2, sieve number 3, sieve number 4 so, here 1.25 mm you know size.

The size of the opening in 1.25 and maybe this is 1 mm and this will be maybe you know 0.1 mm and this will be 0.062 or 63 mm or 63 microns and the last you have a pan. So, you put the material and sieve it and it will you know segregate or divide the sizes into different ranges size ranges.

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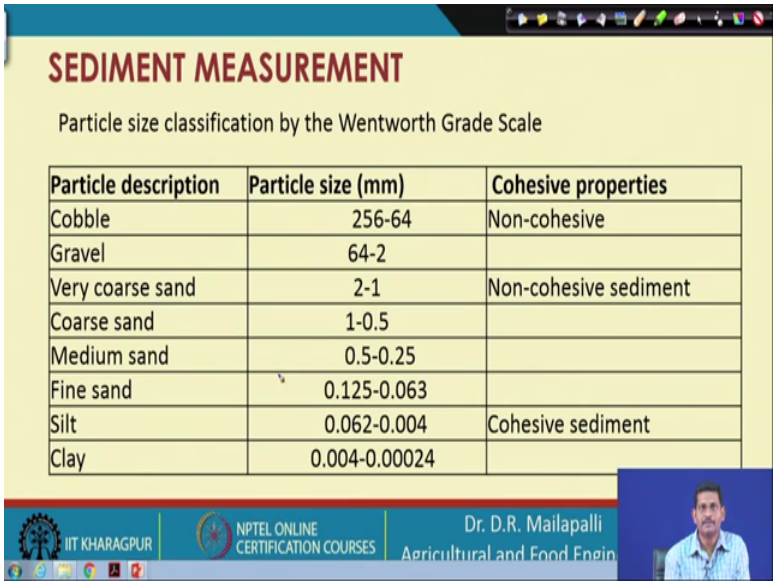

Then, so, knowing the particle size so, you can decide what the particular size refers to. So, suppose if the particle size is 256 to 64 mm we call cobble and 64 to 2 mm is called gravel and 2 to 1 mm very coarse sand and similarly for clay and silts and fine sands are denoted with the different sizes.

So, the mostly the cohesive sediments or the silt and clay and non coercive sediments it is like mostly the coarse sand and cobble, so, the bigger sized particles.

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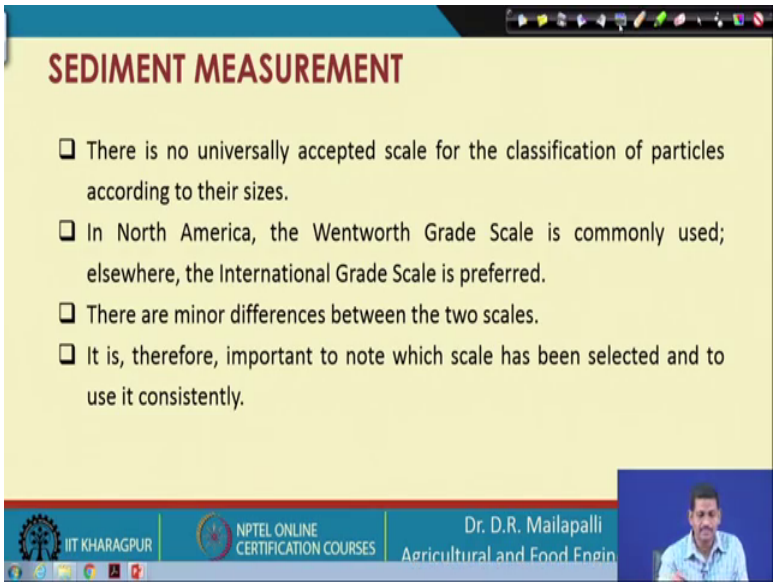

So, sediment measurements there is no universal acceptor scale for the classification of particles according to the their sizes. So, there are USDA size then ASTM and BIS, so, there are several you know what you call these standards available to decide the sizes. In North America so, the Wentworth Grade Scale is commonly used elsewhere the International Grade Scale is preferred. So, it depends on you know different you know organizations the standardization with decided by different organization.

There are minor differences between the two scales. So, the size ranges you know may not be varying too much, but minor variations. So, therefore, important to note that scale has been selected and to use constant consistently. So, once you use a particular system so, go out with that system can throughout your study.

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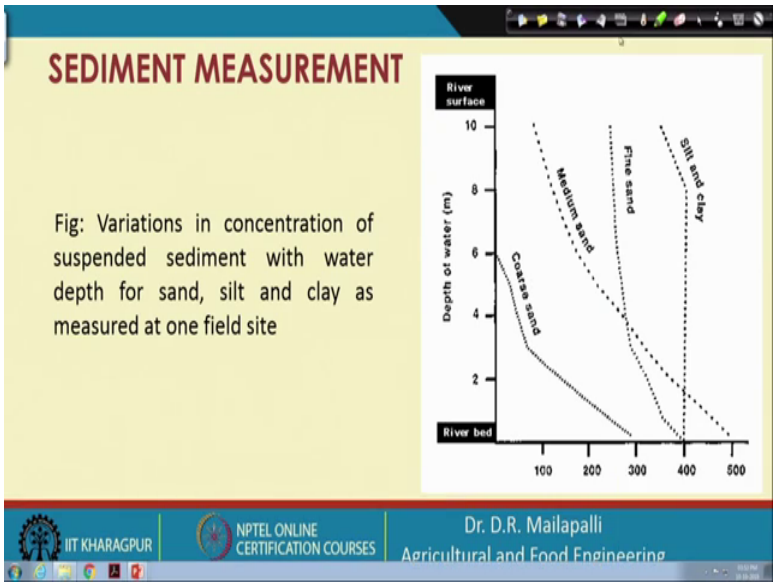

So, sediment measurement here this is this figure variations in concentrations of suspended sediment with water depth for sand silt clay as measured in one of field sites. So, in one field site if you see the this is a riverbed and this is the river surface so, that is why it is a 0 to 10 meter top and then from this is the location where you collected, I mean this is one low fields or location and from there this is a distance.

So, the coarse sand if you see so the silty will be residing on top right, silty and clay because it is suspended and fine sand and the next and medium sand and the coarse sand in the last, ok. So, initially so, the heavier particles will be you know heavier particles will be it I mean nearer to the bed and then lighter particles will be nearer to the surface.

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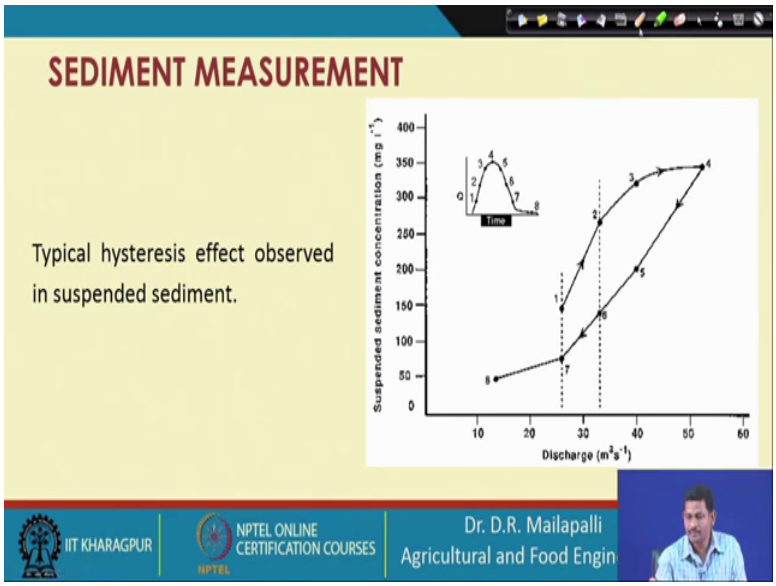

The sediment measurement here if you see this as an hysteresis. So, hysteresis effect observed in suspended sediments so, the because if you I mean this is the 4, this is the hydrograph you see. So, the fourth is the peak right. So, since it is a peak you get maximum sediment concentration here because the discharge is maximum and you get a maximum sediment concentration.

So, since it has peaks like you know rising limb and falling limb; so, the rising limb during the rising limb so, you get most of the sediments out and since the water is accumulating and increasing the wash load. That will increase the wash load you get a maximum concentration, but during the reseeding phase or falling limb the suspended sediments so, the sediment concentration will be less. But, it would not you know follow the same path as it before right. So, A to B, if you see B and A so, A is a starting point B ends somewhere. So, that is why, so, the hysteresis of the sediment suspended sediment is due to the I mean hydrograph characteristics against.

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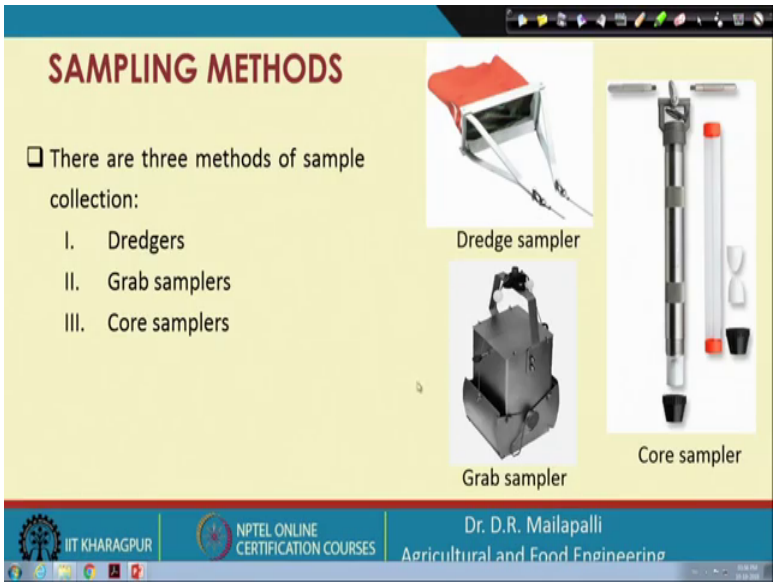

The sampling methods here mostly for sampling you know sediments you have a dredgers grab samplers and core samplers. So, dredgers or like you know the drag unit which has which has a net and at the end and the grab samples so, it grabs you know it has a heavier the box which falls into the ground and when it when it falls down it opens up and then I mean there is a I mean there is a hook on top or the mechanism and top you can close it, so that it automatically closes the bottom and you take all the sample out.

And, the cores are like it goes this is the vertical rods and using that rods we it has a sampling you know the sampling spaces in between. So, once the holes once you take out the sample out cores sample out you can take out the particular and the sample at a different depths.

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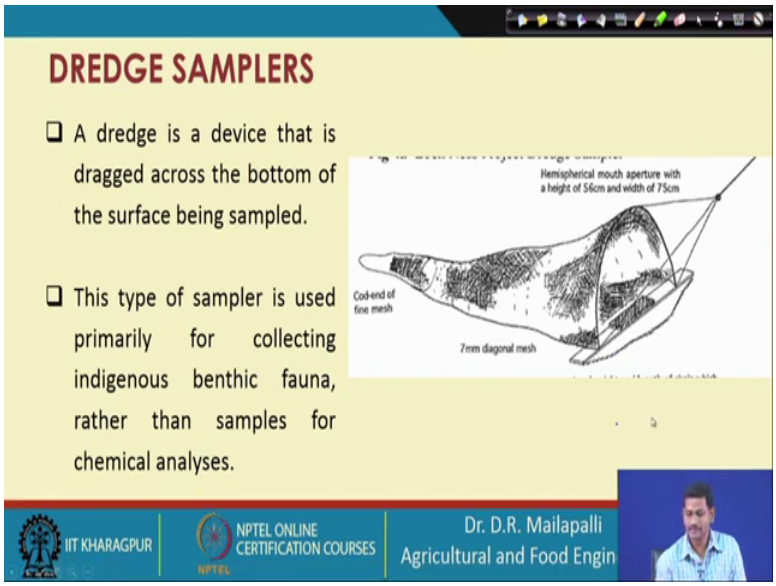

So, dredge samples are like I said so, it has a the fine mess at the cod-end ok; so, hemi spherical mouth aperture with height of 56 centimeter and width of 75 centimeter. So, if you see this is kind of you know the this is going to use to collect the bed load basically 75 diagonal mesh. So, 75 mm diagonal mesh. So, the mostly the bed load can be taken out.

So, the dredge device that is dragged across the bottom of the surface being sampled and this type of sampler used primarily for collecting indigenous benthic fauna, rather than samples for chemical analysis. So, this is simple because it collects the bottom. So, the bottom so, we will be looking at the benthic fauna like you know like some aquatic you know animals, so, aquatic life. So, that can be or aquatic you know creatures can be collected so, along with the sediments here, ok.

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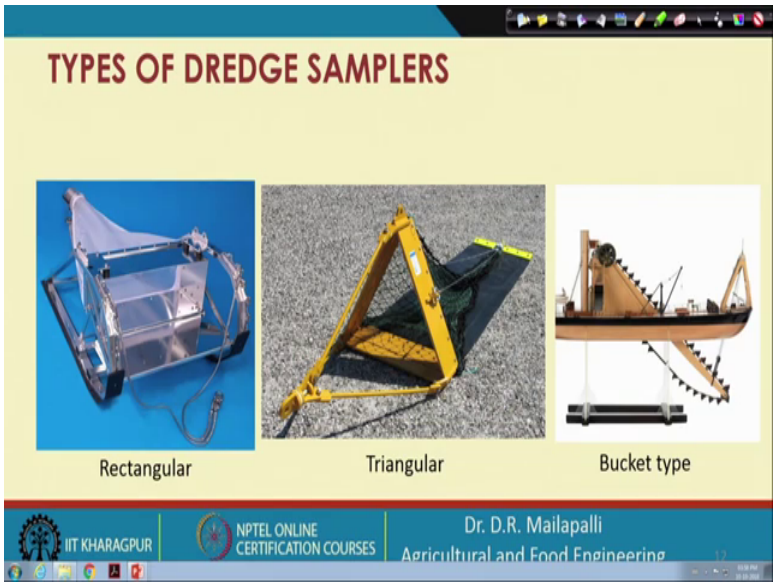

So, the next is the types of dredges if you see. So, it could be rectangular like opening is rectangular or triangular so, it is the opening is triangular or bucket type. So, here if you see so, this from here so, the they did you know particles will be taken away. So, let dredging right. So, this is a bucket type.

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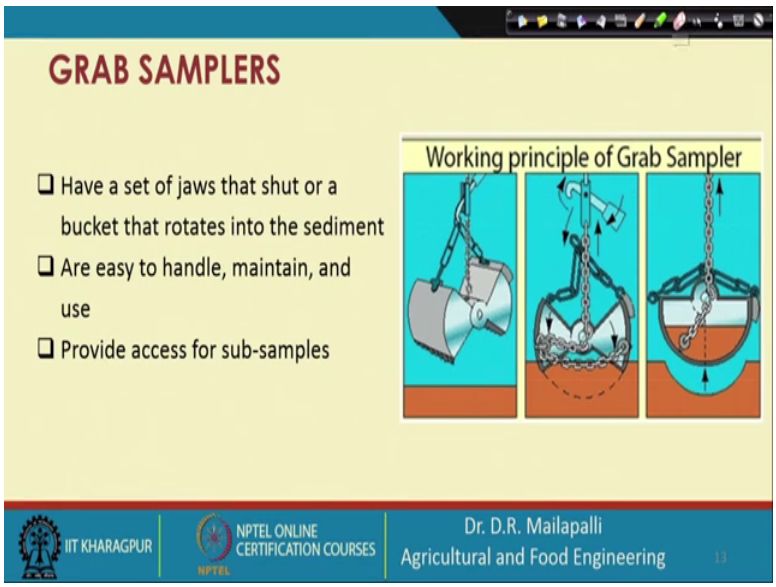

And, then grab samples. So, this is the grab samples or this have a set of jaws that shut or bucket that rotates into a sediment. So, if you see working principle of grab samples initially so these two buckets are open right initially when you when it is going down it

will open this is the you know the sediment you need to collect. So, once at the bottom so, because of the weight what happened; so, here there is a hook when you take it out, right so, this hook will be taken out. So, then the chain will be released. So, once the chain is released so, because there is no support here and this will be fallen down and this will be closed because of a heavy weight. So, once it is closed and you can take out the sample to the top. So, are easy to handle and maintain and use, provide access for subsamples ok.

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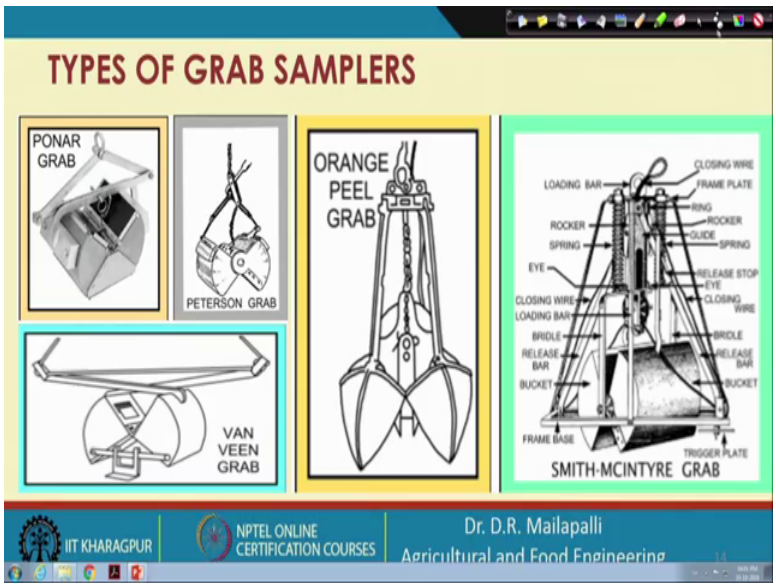

So, the grab samples are different types. If you see here this is called Ponar Grab. So, ponar grab samples the similar to that. So, it has a two buckets here, right once it hits the ground the buckets are going to close. So, similarly the Peterson grab sample just we I have seen in the previous slide and the orange peel grab. So, this has you know this is a three bucket. So, this is 1 2 3 and they are going to the similar principle once they have gone down and the chain will be you know released and due to the weight it collects the you know collects the sample sediments and when you take it out the all three buckets are going to close and you can take a sample out.

And this is Van Veen Grab this is another kind of graph and this is a Smith Mcintyre. So, Smith Mcintyre grab sample. So, this is little complicated, but it is I mean will be used in the deep waters.

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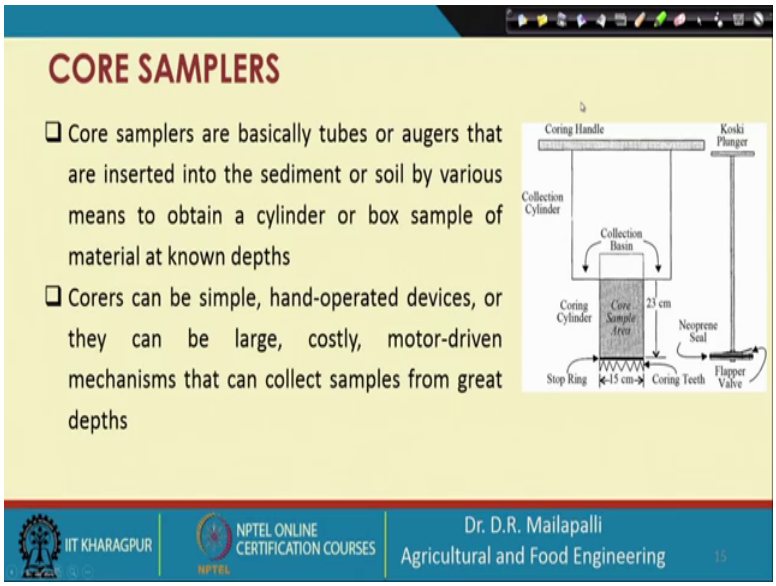

So, the core samplers the other category is the core samplers. So, the core samplers are basically tubes or augers that are inserted into a sediment or soil, but various means to obtain cylinder or box sample of material known depths. So, the advantage with the core samplers are you can get samples vertically you know down from the top to bottom at different design depths. So, for example, here the core handler here so, this is the core sampler and this is the core to I mean this will be the core cutter, this is kind of a core teeth. So, this will make you know it will make easy access to the ground, ok.

So, once the sampling is done if you take out you can know exactly what depth of sample has been taken and corers can be simple hand operated devices or they can be large costly and motor driven mechanisms, so that can collect samples from great depths. So, if you are going to collect sample from you know deeper waters then even in that case the cores are helpful right, but you need to use heavier you know kind of a rigs so that you can get the cores sample from deeper you know deep waters.

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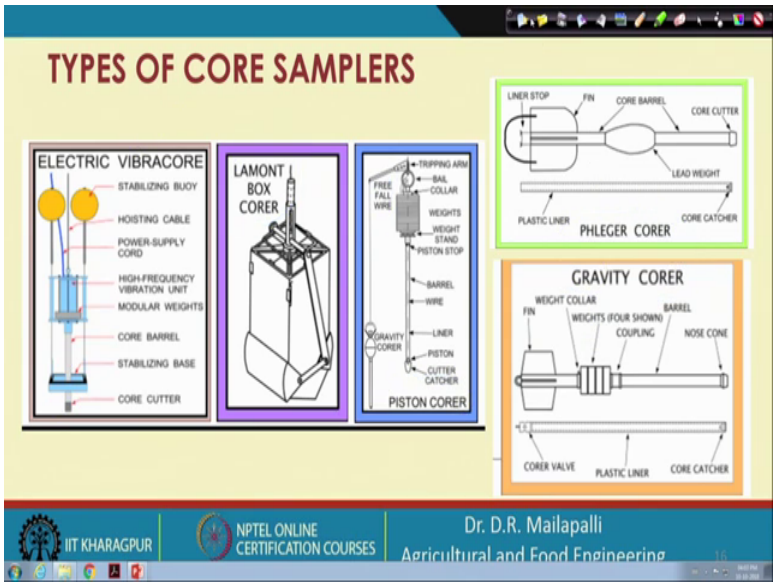

So, the core samplers could be electric vibracore. So, it is basically so, the vibrations which are generated will be used to you know loosen the soil here, right loosen the soil and that will be collected in the cores. And, Lamont box corer. So, this is another similar to your what you call the box type sampler we have seen just.

And the piston corer, so, this will be a to and fro motion kind of thing. So, with this so, because the piston movement it goes down and in that way it goes down it is a freefall wire, ok. So, a it works on the principle of in to and fro or like a piston movement and collect the sample at the desired depth and a Phleger corer this is another kind, a gravity corer. So, due to gravity it goes and collect the because of the weight of the sample it goes weight of the core it goes and hit the hit the ground and collect the samples here.

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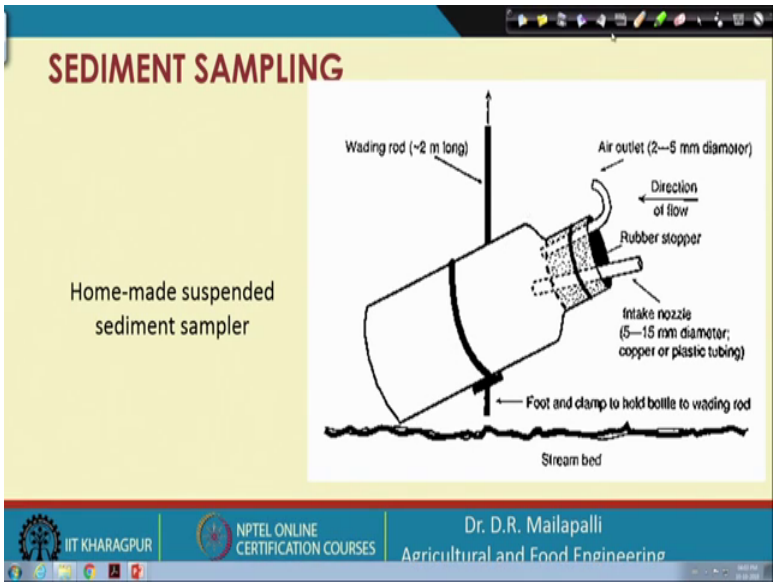

And, the other one is homemade suspended sediment sampler. So, this is very easy. So, this is a bottle if you see he this is the bottle and then it has two tubes; one is the air outlet tube and then intake nozzle here. So, mostly this is used for getting the suspended sediments. This is a rubber stopper here right. So, this is inlet, so, suspended sediments will go in and trapped here right and then clear water will or air whatever it may be so, that will be passed out. So, that way so, and here this will be tied to a vertical pole. So, that it would not float from one place to another plate place and this is very easy used for suspended sediment collection.

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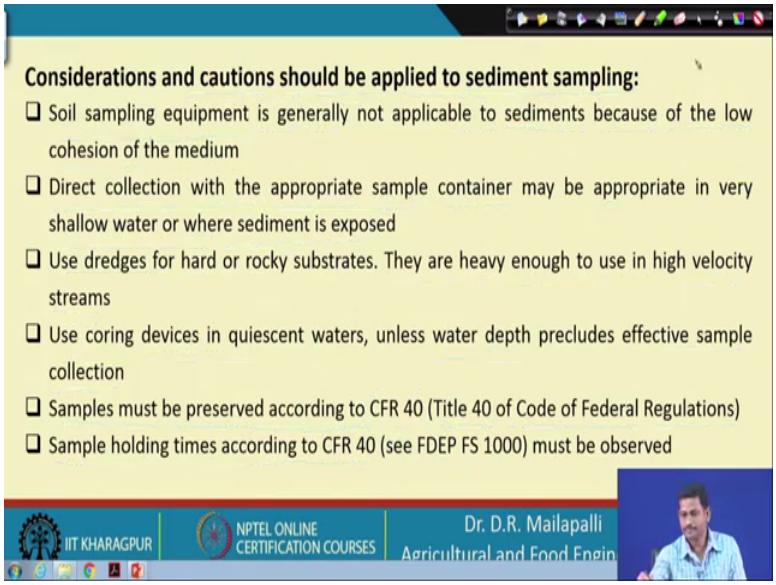

So, then so, the considerations and cautions should be applied to sediment sampling basically. So, the soil sampling equipment is generally not applicable to sediments because of the low cohesion of the medium. So, here soil samples for example, soil cores and other things or augers so, they may not be applicable here in case of collecting sediments because the sediments or like a cohesive soil is most is silts and clays so, will be much careful. So, better use sediment sampler rather than soil samples.

Direct collection with the appropriates sample container maybe appropriate in very shallow water where sediment is exposed. So, shallow waters if you have shallow water I mean sediments so, data collection will be easier and also it is a appropriate compared to the deep water and you may get accurate or accurate depths you can collect the samples here. Use dredgers or hard for hard rocky substances. So, dredgers are very useful which can collect the you know rocky samples. They are heavy enough to use heavy velocity streams.

Use core devices in quiescent waters. So, the quiescent waters means you are not having turbulence in waters, unless water depth precludes effective sample collection. So, unless there is a deep water or anything there is a difficulty in reaching the ground so, the core samplers can be used in quiescent condition. Samples must be preserved according to the CFR 40. So, the CFR 40 is the this is the Title 40 of Code of Federal Regulations of United States. So, the sample holding times according to CFR 40; CFR 40 has code of conduct for collecting sample preservation and all other things. So, we need to you know you need to follow the recommendations while taking the samples and while preserving the samples and analyzing samples ok.

So, this is all about the sediment sample collection. So, as I said basically we will be collecting sediment suspended sediment as well as bed load. So, there are several devices will be used to collect the samples; it could be you know dredgers, soil cores, I mean core samplers and the graphs or simple handmade you know suspended sample collectors. So, and in order to collect the sample, in order to you know preserve the sample we need to you know use the CFR 40 or you know the 40 I mean the stand this is the standard mostly the United States are being used for collecting and preserving the sediment samples, ok.

Thank you.