Geotechnical Engineering I
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Lecture-06
Soil constituents-I

Until now we have discussed quite in details origin of soils their deposition, their transportation, how would you classify them based on different schemes, particularly the geological classification I have talked about and subsequently I will be discussing about the engineering classification schemes for soils. I have try to give you an overall picture about what the subject is, what the material is, what we are going to discuss about in this course, why this is essential.

So if you remember last lecture when I showed you the ppt's and I had compiled lot of situations where the knowledge of soil mechanics is required to deal with the situations and I had termed this as problematic soils and the way engineers and technologists will take it in today's world is what is spoken known as challenging situations. So when we study geotechnical engineering 1 or soil mechanics 1, the whole idea is to understand the material the way we try to understand our friends, our neighbors, our colleagues, and then how to deal with them, how to negotiate with them.

The language which we use for negotiation would be you know, it could be mathematical, it could be physics based, it could be chemistry based, it could be a combination of all those things. In short, how mechanics is use to solve these problems which you might have appreciated in the previous lecture this is what the theme of the discussion would be consequently. So having done the origin, genesis of the soil, how it gets deposited.

Now today I will be talking about what are the constituents of the soil and what are their properties. Because when you try to understand a person or a situation, it becomes quite important to understand, what are the constituents of this material.

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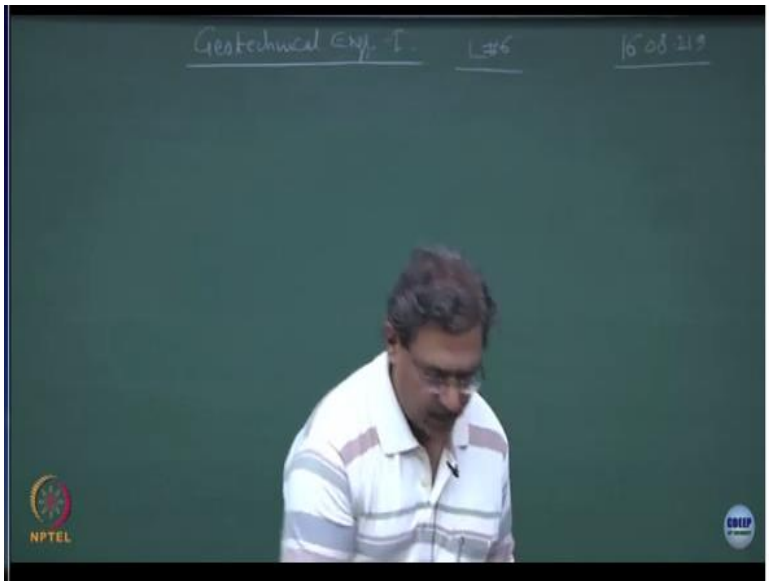

So today's lecture is based on this theme this is the, so I will be talking about the constituents of soils.

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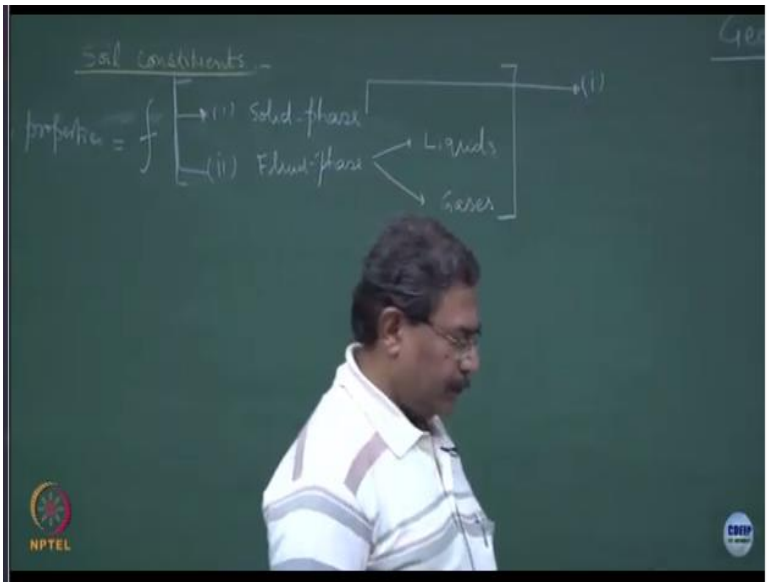

There are basically 3 types of the constituents, the first one is the solid phase, the second general category would be the fluid phase and within the fluid phase, we will have liquids and gases do not you think that this system is just like human beings, you see if you see our body we have all three phases is it not. We have fluid, we have gases and we have skeleton bones which are the solid phase.

So this is a philosophy which I use to define the soil mass and the way the soil technology can be created in another course not in this course, that means this system consists of solid phase, liquid phase and gaseous phase. Now, what happens is the engineering properties of the soil are going to be a function of all these properties is this is ok. So when we talk about the Engineering properties they are going to depend upon all the 3 phases that is solids liquids and gases.

Solids are nothing but the minerals we will discuss about this in details, liquids are it could be water, it could be the effluence coming out of different industries in the form of the pollution. The gases could be air or this could be different type of gases let us say methane gas, carbon dioxide combination of all these things vapors, water vapors. A simple example would be if I take a soil mass which is saturated, saturated means the one which is soaked in water completely.

If I take it out of the water and put it on a oven, so slowly and slowly what is going to happen is that the soil mass gets dried up. That means, what is happening is, there is a conversion of fluid phase from one phase to another phase that means the liquids are getting converted to the gaseous phase keeping a skeleton constant. But suppose if I elevate the temperature so much, which is beyond the melting point of the solids, what is going to happen. The entire thing will become it will melt, it will become like lava.

These concepts are being used in today's science and technology when we deal with the soils, particularly radioactive waste disposal where suppose if I want to remediate the soils, which are heavily contaminated alright. So what I will do is, I will quadroon off some area, I will use laser torches at very high temperature 2000, 3000 degrees centigrade and I will what can I do with the soil now, what is this process known as vitrification correct say it loudly.

So this process is known as vitrification, now this is a very bigger scheme which you can follow in today's world. You know there are not many specialists who can vitrify the contaminate soils and this is a big challenge in the country, how would you deal with these type of situations ok, so let us come back to the conventional thing.

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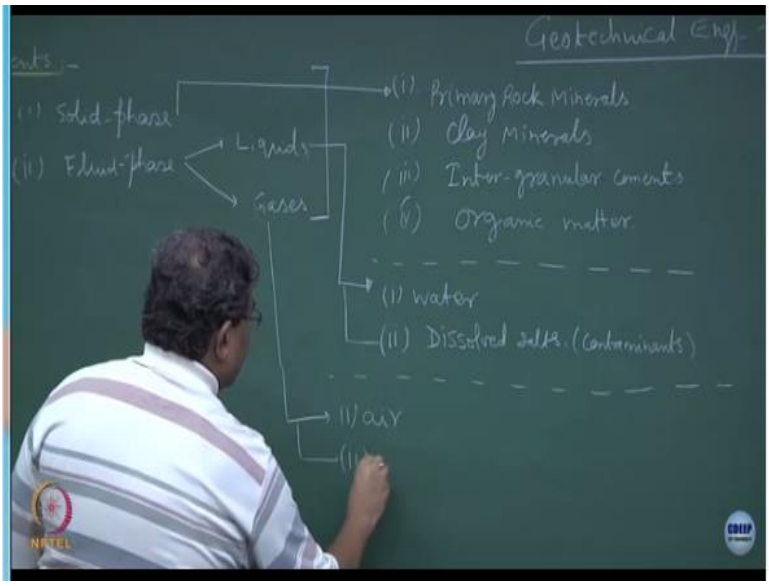

The solid phase consists of primary rock minerals, clay minerals, the third one is inter-granular cement, somebody was discussing about this in the first lecture, the cementation between the 2 particles I think I gave you enough logic also and the fourth one is organic matter. In modern day application of geotechnical engineering, all these constituents play very important role.

So it depends upon the way I want to doctrine, you understand what is the meaning of doctrine a material, how I want to you know overpower the material, how I want to negotiate with the material, how I want to utilize the material. I can use these phases to solve a given situation, we will discuss about this later on. The second phase is the liquid phase, so here we have either water or dissolved salts.

Now when I said dissolved salts these are mostly contaminants whenever you get free time, please check it on net. There are lot of researchers who are working in the field of contaminant transport in geo materials alright. In western world there is a big fashion most of the problems where the industries would like to sponsor research and where they would like to appoint you guys with the knowledge of subject would be mitigation of contaminants in the soils and rocks, which becomes a geo environmental study, the as far as the gases are concern.

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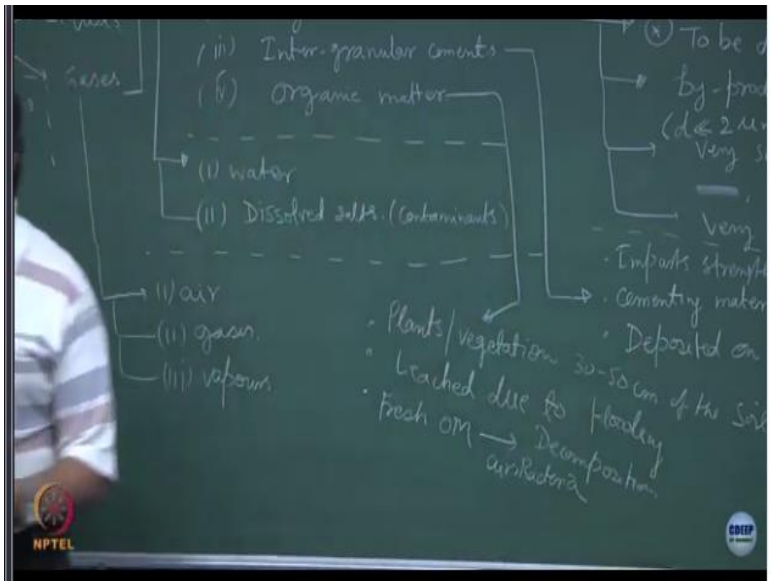

We have air it could be gases which might produce because of disintegration also of the soils and why disintegration should occur because organic matter is already present here we discussed about this if you remember. So organic matter when it comes in contact with moisture, humidity, temperatures, bacterial activity, it might produce gases clear and those gases may get trapped into the matrix of the soil and hence this becomes a constituent.

We might be having vapors also, one thing you should realize most of the textbooks deal with the conventional geo mechanics, conventional geotechnical engineering conventional soil mechanics, they are not very contemporary. So what I try to do here is I try to give you an idea about the contemporary subject by including the examples of by shading the examples which are going to be useful an understanding the subject in a holistic manner alright.

So that is a state of the art of the material otherwise there are so many simplifications with which the conventional subject deals with. But now the time has come where all of you should be aware of what is latest, I hope this is one of the reasons why people do not like civil engineering number 1, why they are not getting jobs number 2, and why they are not into different areas of activities which they are they could have done in the best manner number 3, alright. So in most of the textbook you will find like this, now let me add one more phase.

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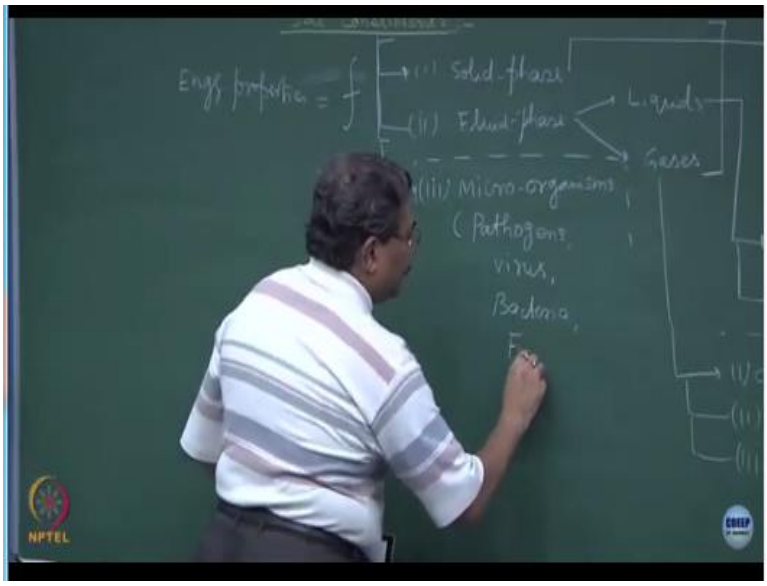

I hope you will agree if I add let us say bioactivity microorganisms is this correct. So this becomes contemporary geotechnical engineering is this fine in textbook you will not find this. So should I teach all these are not any after effect of this what will happen, suppose if you know all these things microorganisms when you talk about microorganisms. So as a third year student you can eliminate this part completely, this just for general knowledge.

We have pathogens you must be studying all this in environmental engineering courses also, virus alright, we have bacteria, we have fungi correct that also gets transported. So whenever you get time please go through their papers and see what type of systems we have been talking about and how do these systems constitute the soils.

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So now coming to the primary document minerals see these are basically the pieces of rocks which gets disintegrated, disintegration is nothing but the weathering also alright and the attribute is that this would be having several minerals. So there are few guys who are experts in petrographic examination, I think we discuss about in the first lecture, I will take out a rock sample I will cut a thin sample most in earth science department what they do is they will make a ultra thin sample.

And then they will try to study the microscopic feature, the mineralogy, the compactness of the minerals, age you know carbon dating and all those things people do. As far as geo technology engineers are concerned pieces of rocks which are disintegrated from the parent rock, parent body I will write which is nothing but rocks and the diameter of these particles is going to be greater than 2 microns is this ok see this is how the classification system started the physics of the material.

Another interesting thing is this is the first time you see we are talking dimensions, so what happens is the primary rock minerals are the ones who guide mostly the engineering properties of the soils.

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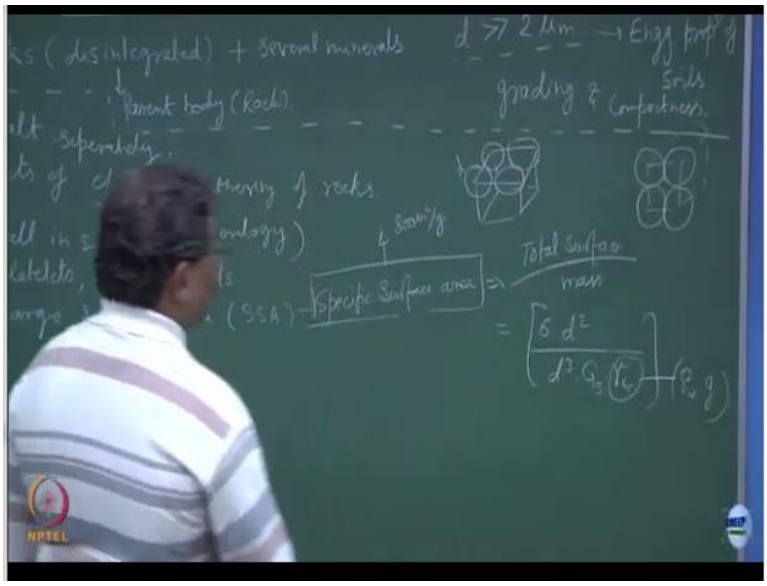

So, these are the ones who are responsible for engineering properties of the soils, we will be talking about different types of engineering properties, how would you compact them, how the water permeates through them, how gases permeate through them, how to consolidate them, what will be the strength of these materials, when do they collapse and so on. So here we are more interested in their grading and compactness.

Now sometimes this is also known as skeleton, this is the skeleton of the entire soil system. So suppose if I am coming from Unilever for that matter alright and company ask me to design different type of soaps, lipsticks, different types of cosmetics alright. So next time when you use soap you will realize that this soap is nothing but a multi phase unit constituting of all this and in this system I can add one more perfume plus one more colour plus one more detergent plus one more durability.

So sometimes soaps melt in the bathroom clear some soaps do not melt why, you can do engineering of the matrix of the system which constitutes of mostly rock minerals, we will talk about these details. The second in the series which is very, very important is minerals like human body, what is the importance of minerals in human body. I hope you understand you take food and there is a balance diet would be the diet which has several minerals in it clear.

So suppose if I ask you to run from IIT campus let us say extreme hostel number 15 to main gate during summer peak summers. Those of you who are champions you can run 25 kilometer, 50 kilometers, 100 kilometer, people like me can run say 1 kilometer, 2 kilometer, another person cannot run even 300 meters, what will happen he sweats clear and what happens during sweating.

Most of the members moves out from the body oozing out means they get discharged from the body through his skin clear. And in the process, what happens if I ask you further to exert yourself you may collapse clear the same is the situation the soil also, later on we will see if I do not control the mineralogy if I do not control the minerals properly in the soil with proper nutrition, with proper water what is going to happen, the whole system will collapse.

And then there is a case like railway track collapsing, embankments collapsing, dams collapsing and so on alright why. Because the minerals have become altered or the right minerals are not used or the nutrition was not given, whatever you can think of on your (()) (18:16). So as long as clay minerals are concerned, I will be discussing about this in details in a separate lecture.

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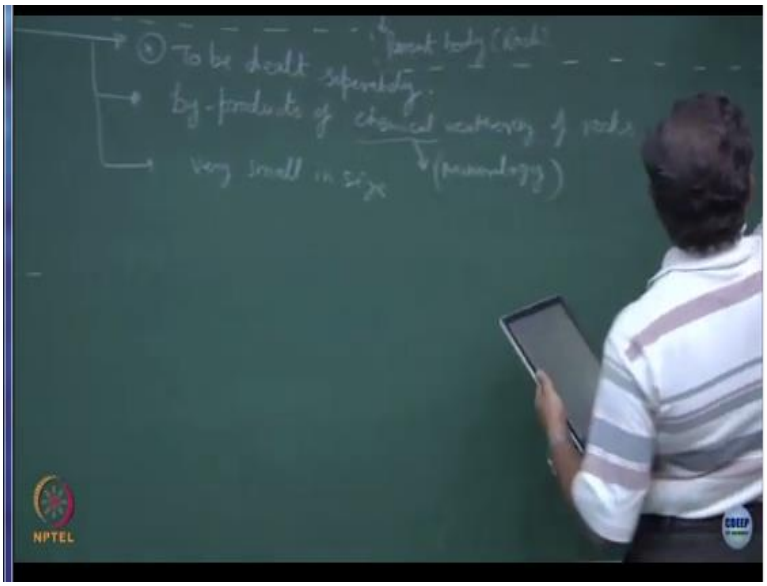

Because as you must have realize from this discussion, clay minerals are the most important thing in the metrics of the soil. So this will be discussing separately, normally these are the byproducts of chemical weathering of rocks. I hope you understand the difference between the 2,

the first one which is primary rock minerals is a physical process based on only the size clear. This process is clay minerals are mostly formed because of the chemical process and this chemistry of the material guides it is mineralogy alright.

So, mineralogy is nothing but a chemical form of a material, so this influences mineralogy will spend enough time on this to study, normally clay minerals are very small in size. So the way I wrote here d is the diameter of the particle alright or the size of the particle, particles need not to be a spherical all the time. So when we talk about the clay minerals, these are not spherical particles they are going to be needler alright.

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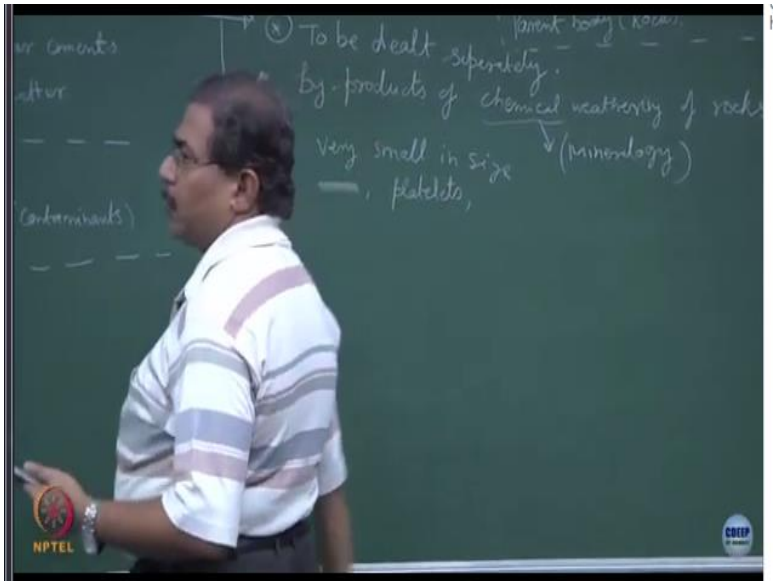

So they will be needles, platelets, mostly tubes and rods, incidentally bacteria is also like that, are you realizing this. Most of the time bacteria is also either tubular or in rod form. Now these are wherein good interaction you know bacteria interacting with the clays and what happens and why. They have very large surface area and we call it as SSA, we call this as a specific surface area and this is basically the total surface divided by per unit mass.

So suppose if I assume a cubic structure alright this is a basic unit of a structure, where these are the particles of the soil, I am assuming them as perfect sphere. So you can imagine if you see the front view, you will find there are 4 particles sitting like this and I can always construct a cube

out of it is this ok. So d is some dimension now this dimension could be the diameter in case of the big particles if they are rounded or this could be platelet.

So I will simply say the length is equivalent to d, so what I am trying to emphasize is these sizes are going to be extremely small and they are less than 2 microns. So the first difference which we have created between the different constituents of the soils is based on the physics clear. The second one is based on the chemistry and both these things are coming from the weathering process, you take a hammer and start hammering on a big stone.

So what is going to happen after 1 hour everything will become pulverized and it is up to me I can use ultra you know pulverizers also and I can crush it to small, small particles even less than 2 micron also nano size particles. Most of the Ayurvedic medicines work on this principle what do they do, have you ever seen Ayurvedic doctors no they have a pistol and mortar, so what do they do. They will put some tablets and the keep on you know, crushing them why the more finer you crush, the more active it becomes.

In other words, what I am going to get is by decreasing the size from here to here, you are reducing the size of the particle you are making system ultra active. So this material was a stone, it was a good paperweight for my office, the moment I crushed it I made it nano particle size, it becomes what a medicine you understand. I can put it in concrete, the durability of the concrete will become 200 years, 2000 years.

So all these Roman people, Roman Empires, they were so intelligent, what did they do, they took rice husk, they took bagus, bagus is residues of the sugarcane. They incinerated it and after incineration, what happened these material got converted into ultra fine silica particle clear and the moment you put it anything, it becomes hyperactive. So the cement with they are used 2000 years back, 3000 years back is still the walls are there go and visit it the entire Rome anybody has been there.

See these should be very good, you have been there where, Turin, ok you have been to Rome very nice. So all the structure which you are seeing over there, how many years old there 1000

years yes alright and see there, excellent that why and we cannot make buildings for 50 years even, what is the reason, the basics and science behind the materials is missing, though we have beautiful SCNs microscopes and what not, but we are not using the knowledge good.

So did you follow something interesting, if I start from here if I crush it by grinding, there are many companies in India what do they do they take slacks from in steel industry and they pulverize it to the nano size they call it as micro cement, ultra fine fly ashes. And what do they do, they directly add it to the cement clear that is it, it becomes green cement. So, remember the moment particle size decreases, the specific surface area increases when specific surface area increases, this material is bound to become hyperactive.

So what can I do if I use the right species of the rocks, right species of the minerals they will be having medicinal value metro gel, what is metro gel medicine. When you have loose motions, stomach upset what do they do, they will give you a capsule of a sort of a mineral that is it ok. So that is what I said this was a paperweight for me big size particle what I am going to do with this nothing just they put it on the desk, crush it and see the magic physical alteration alright.

I have increase the activity, now this activity I can do in several ways, nature does by chemical weathering. In an industry you can open up a industry tomorrow, collect all the dust which is lying outside your industry, process it by different type of chemicals. And you can produce best possible best grades of minerals which you can sell in the market is the big market in the market clear you can sell it

So, I hope you are realizing, how nature what it has done in millions of years, I can do it within few hours and that is R and D that is science and technology you understand and then I can use for any commercial purpose, read some of few who are interested in opening up your industries silicon reduction technology SRT it is a beautiful subject to work on, whatever clays, sands are lying over here and there, if I can process them and if I can take out the silica in a suspension form.

Somebody was asking about this in the very first or second lecture, if I can take out all the silica from these quartz particles and I can make a suspension. This becomes a beautiful medicinal application in terms of transplantation, I hope you understand different type of bone marrow replacements, different types of you know cosmetics and whatever, wherever it has been used. So this the scope of the subject I hope you can understand lot of things can be done with this material is the magic material is this ok.

Because we are in the profession, we use it for making buildings, foundations this, that is this part clear. Sir when we were talking about that if we see the size of a particles increases their activity, so in specific what kind of activities are this is ok. So the quick answer would be I would like to use them as chemicals, what is the difference between homoeopathic medicine, ayurvedic medicine and homoeopathic, ayurvedic and allopathic what is the difference, quick relief. long term homeopathic somewhere in between allopathic immediate and further injection.

So whatever suspensions I have taken out from the stones, I will take them out chemically I will inject in your body done. I use this concept who treat most of the caves and their statues in the Ajanta and Ellora this was a beautiful project which I get, I did the dripping of the statues with the calcium silicate getting the point. So micro material it can be injected into any system and this becomes a strong system durability is this ok.

The second thing look at your question repeat your question again another angle of your question yeah, what activities are talking about (()) (29:32) sometime back I was talking about the Deccan trap, the Deccan peninsula phrasal granite whole the years what has happened, millions of years what has happened, the weathering is going on in the natural process, resolution we were talking about resolution of rocks.

That means this rock got weathered physically chemical action started, what happened they got converted to very fine clays marine clays they got deposited there. And marine clays have lot of chemicals into them chloride, sulphides, carbonates, bicarbonates and this is a whole world of you know microscopic activities which is going on inside. So now I hope you are realizing that from where to where to where we can feather we can travel is this ok.

So normally, if I consider this as d is the particle diameter though this is not valid for fine grain material, why because fine grain materials will not have a spherical particles or diameter d but this an assumption. So here the surface area would be 6 times d square this is ok, 6 phases of the cube, so total surface area 6 d square this surface area is available for the mineral to interact with water, interact with contaminants, interact with environment, interact with fertilizers, interact with microbial activity.

So the more and more surface area you produce, so suppose you have facials you use know multanimetti and all fine particles bentonite if I put it over here, what is going to happen. This material has such a high surface area that will take out all sorts of dirt, sweat, microbes, whatever from your skin and skin becomes fresh is this correct this is a mechanism. So this one example I have given you, I have dysentery, I have enough water in my intestine use the minerals in right dose it goes in the stomach, it forms a big gel blocks intestine job done as simple as that this is fine.

So this is and mass how do you compute the mass of the system, so volume is known d cube and multiplied by density. So density of the system would be, I will use the word G, G is known as specific gravity we will discuss about this later and to define this specific gravity of the skeleton of the soils or minerals, we will use as prefix as Gs. But after this discussion I will not use Gs ever for the sake of simplicity clear, so G is the specific gravity of the minerals.

So this thing multiplied by gamma w, what is gamma w sorry this is the unit rate. So, in geotechnical engineering you have to be slightly careful about this term, because the moment is certain context comes you will find that gamma w will go for, so gamma w is the unit weight of water which is density of water multiplied by G value clear. So this term is density of water multiplied by G, this is a surface area.

So one of the ways to classify the minerals has been based on their SSA, so suppose if I ask you that there is a mineral like let us say montmorillonite which you are talking about this SSA would be almost 800 meter square per gram 1 gram of the montmorillonite will show you how

many meters square of the area, how many of you play football, hockey, what is the size of the hockey field approximately 900 by 90 by so 90 into 40 how much 3600 meter square.

This material is 800 meter square per gram of the material imagine that means 4 grams of the material is going to show you the same area as of the hockey or football field, are you getting a feel of it, did you get a feel of it. In most of our Indian marriages, what do they do, they have this Haldi function is it not, what is the Haldi functions. In Hindi they call it (()) (34:34) I do not know what you call this in Telugu and I mean they will use rice flour.

They will make a wall of that by adding water and they simply put on your skin, why this powder is already in the final form of grains correct and you add water and then this becomes the best possible disinfectant along with turmeric, got it this is the basics of the entire thing. It all depends upon you in what profession you are and the way you want to exploit the potential of this material you want to use this metal as a bowler or as a batsman or the wicket keepers is up to you or as a twelfth man, agree.

This is the number most of the current practices in a mineralogy are based on this number. When Fukushima accident happened, few years back, somebody contacted me and they asked me to convert the material on which I do my research to bring this very close to 560 value. Because then they would have used that material directly from India, they would have spread it on their beaches, what for good example of surface area whatever radioactivity is spread on the beaches, these minerals and simply hook them up they will not let them go.

They become naturally occurring surfactants, cleansing agents understand, you got it. I can use them in medicine, more surface area that 1 gram what is the size of the intestine I am sure not 800 meter square for 1 gram of the thing. So what is the size of the capsules and the medicine which you take approximately 1 gram, how much minerals are going to be fed into a stomach, imagine and what do they do, they clog the entire thing.

So the more and more water they come in contact, the more and more water gets sparked on them. So the next lecture we are going to discuss about the whole chemistry of this process,

electrochemistry of this process. But if you realize that most of the discussion is revolving around the applications spot industrial applications spot. And this is where you will see that these 2 subjects you cannot get rid of ok let us move ahead.

So incidentally just to give you an idea about the clean sands, have you ever seen a scrubber which is made up of clean sand, the scrubbers I think you understand what does scrubbers, see when your feet become very dirty, what do you do, give me the stone, yeah. So whenever you know elbows or feet become very dirty what you do, you grind them with this correct.

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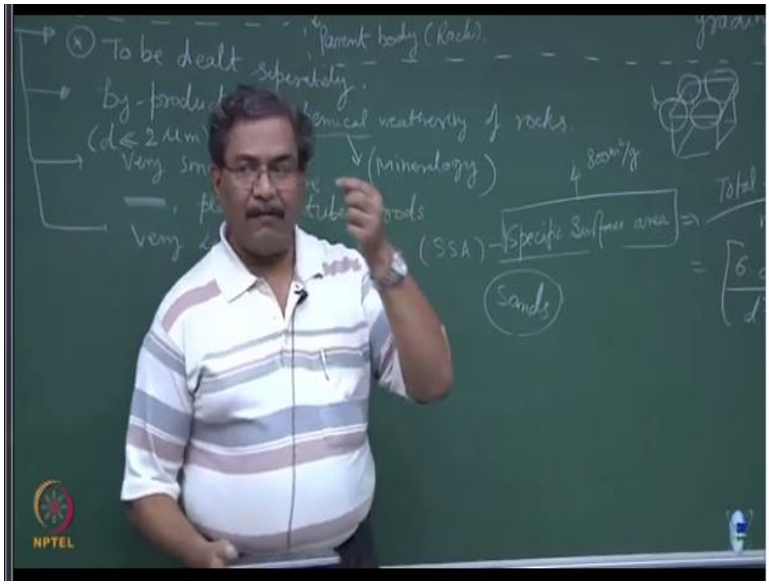

So compare this thing with sands, sands have mostly abrasive effect, there are few detergents which came in the market, when you were kid and hence they were not very popular, but they were very popular because they were very cheap. So they have most of the abrasive effect, now by mistake if you use them for cleaning your let us say steel, cochlear your utensils what is going to happen never leave a mark.

So they started using soft minerals, soft minerals or thin platelets, hyperactive chemicals chemically you just put a drop of it and it will clean the entire system. I can use this for cleaning the plates, I can use it for cleaning up of the environment, oil spills, which happens in sea, oceans you understand. Whenever 2 tankers when and they are bringing oil from different countries and they hit something and there is a spillage or there is oil slick which is taking place.

You must have heard 2 years back of coast of Bombay it happened, how are you going to clean up this system, so this becomes environmental cleanup. So from body cleanup to utensils cleaning to environmental cleaning, the concept remains same is this part clear, have you understood. I have given you the choose for the raw material and believe me, inputs are almost 0 but imagine what you are going to produces much more costlier than diamonds.

So let me talk about yeah, so the logic here is the moment I start crushing them the specific surface area is going to increase it depends upon your crushing ability, chewing ability there is no eat food slowly and chew it properly why to mix it thoroughly with the saliva when I making good cements what should I be doing finest particle mix thoroughly let it set beautiful, extremely. You went to Rome know Rome, so see extremely durable system I can create nothing is going to impregnate through it.

Durability has increased strength is taken care of system can live ever forever ok, so now let us talk about the inter granular cement.

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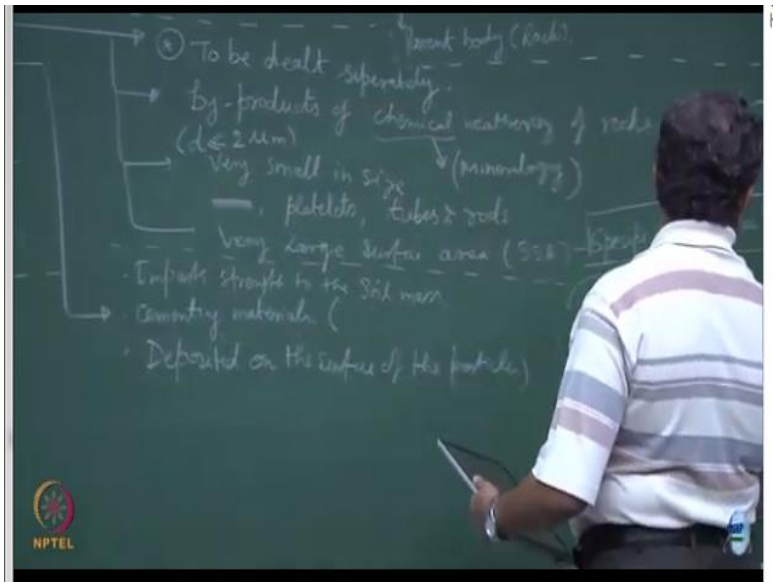

So inter granular cement mostly these are because of the cementing materials and what are cementing materials normally you know, Carbonates, bicarbonates are weak, Iron compounds, Oxides, Calcites. So other day you are talking about MICP if you remember this thing

microbially induce calcite precipitation. So what bacteria was doing it was producing calcite which is getting deposited on the sand particles and the soil mass becomes cohesed cohesion, this thing appears natural, clear.

Many a time the new walk on the sea beaches, you will realize that water does through this sea sand, let me ask you a question you go to a beach or party as long as the sands are dry, can you run on that, can you drive a car on that, yes or no when it is dry why, right first of all answer what is the answer, you have never been to a beach, you can drive a car or not, why, material is frictional fully.

Take this material and do a simple test next time when you go take 2, 3, 5 grams of the soil and rub it and see what is the friction that is friction. You have gone to very hi-fi answers simple things first understand, what is the difference between dry sands and the wet sands, what water does to the sands, what about the surface tension, are you getting the hints, so water in sands make it a strong why, because of the surface tension.

So, on wet sands you can easily drive the car or the you know or side and whatever clear, so water acts as a cementing agent though temporarily you got it. Now most of the cementing materials are produced during weathering of rocks, silicates, carbonates, bicarbonates, Iron oxides and so on depending upon the presence of the you know cementing agent. We can classify sands, if more calcium is present, it becomes calcareous soil alright.

So, calcareous soil is the one with where you have lot of calcium impregnation in the sand particles and calcium carbonate is the deposition which takes place all around the particles. And when 2 particles come in contact with each other they become a unit they get cohesed. So basically this is deposited on the surface of the particles, cementing materials or inter granular cements are responsible for imparting strength to the soils

Later on the second course we will be discussing it in great details about the effect of cementing of the particles on shear strength characteristics of soils, tell me one thing what is going to happen. Suppose if you take an example of calcium carbonate which is naturally existing and

suppose there is an industry which is producing sulfuric acid, now what is going to happen, nearby on the beach itself first of all, what acids are going to do to the carbonates.

I hope you can understand what human activities are going to do to the soil deposits. So suppose there is an effluent in nala you know, most of the time we do not cover them, we do not channelize the nala flow properly. And this nala is coming let say from different parts of Dharavi and industrial units meet a river for that matter. So what is going to happen it is just containing all sorts of chemicals into it.

And suppose chlorides, sulfuric acid, SCL, HNO3, they are too much, what is going to happen, these assets are going to attack the cementing materials which are present in the soils. So what is going to happen, this interlocking of the particles gets dissolute, dissolved, so what is going to happen, when rain come, flooding takes place, excessive are discharged from the industry what is going to happen erosion is this funda clear.

So weather is a natural process or this is a manmade process, soil erosion, how many of you can fight a case in the court of law, that this is manmade, this is not natural. And hence this guy should be penalized and this is the penalty on this industry that is what I do, you got it. So the more and more industrialization happening, what we do people like us, we create a case out of it, we defend governments, we defend individuals, we have a profession.

So I will take samples from that place 20 years back, what happened today's what is happening, I will prove that this is a human activity clear because the top layers only get affected, the bottom is not affected, this becomes forensic engineering a big profession, which is the need of the hour. So for detectives like you do forensic examination, I do forensic examination of different areas, what deteriorated my property, somebody is going to file a shoot know yes, are you getting this point.

So professions are getting generated from the basics are you realizing this many a times sea water because of the presence of all these chlorides, sulphates, magnesium, calcium, sulphur could act as a dissolving agent. We have talked about this in last lecture also, we showed you, so

the moment cementing matter is last inter granular cements are last finished. Another thing common sense says as long as the calcium is present in the body or on the soils what it does it is a nutrient, agreed.

So whenever you have deposits of calcium on the particles of the soils, what is going to happen, these guys are going to be there, is this correct fine. Because calcium is a source of nutrition, so most of the calcareous sands are formed because of the microbial activity ok naturally which occurs in the nature and you will find several examples. I think I have sent you some links also go through that this concept was used by our great Emperors to make their castles, forts and what not and over the years this is not going to get dissolutedwhy.

Because these type of calciums are not inorganic they are sources organic, so most of the dams right now in the country are having a serious problem if you are following the newspaper properly. You must be realizing that most of them are in a serious trouble, why, they were done 60, 70 years back ok and they have not been prohibited yet. So the big issue is there is a scheme of government of the not government United Nations, where they are funded most of the third world countries to take care of their dams.

Because of dams burst you know what is going to happened, fine everything is interlinked, now comes the organic matter.

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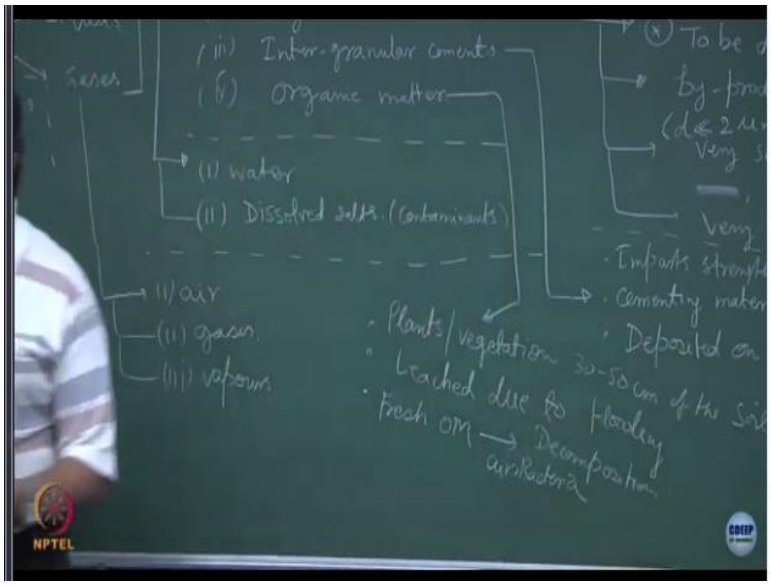

So most of the time the organic matter is derived from the plants and vegetation, decomposition of plants and vegetation, normally top in 30 to 50 centimeters of the soils alright. So this becomes a zone of interest for very few guys, for civil engineers this is not a very good zone to lay their foundations understand, why. This becomes a layer in which the agriculture is going to prevail better because of the organic matter which gets decompose when it comes in contact with water when it comes in contact with atmosphere and so on.

But as far as civil engineering is concerned, geo technical engineering practice are concerned I will make it sure that my foundations arrest where is that foundation guy, yes. So I will make sure that most of the foundations are going to arrest beyond this zone which is inert, now this system is chemically bacteriologically active. So this is the delight of any agriculturist but not for a foundation engineering guy fine, another important thing is organic matters, leach ok.

So it depends upon what form of the matter is which is leaching, so this may get washed out it may get leached due to excessive flooding. Let me ask you a question, how many of you are in favor of making dams and how many of you are not in favor of making dams in our country, why. Suppose if you have to become an advocate tomorrow, you know a mega particle what she has been doing, yes speak it out she was against why, what it has to do with the context of my discussion, see I have written here.

The leaching due to flooding, why am I asking this question, what is the relevance. One issue, social issues displacement of the people alright, number 2, no water reaches. So we will discuss this that how creation of dams next at joining lands barren, so if the case comes to me to fight, you know if somebody appoints me as a legal advisor what I am going to do, I will prove that making of this dam is going to create the lands barren is not only the displacement of the people, of course that is number 1 social issue.

But more than that the technical issue is we will talk about these analysis, that how the water which is percolating through the body of the dam is ultimately going to wash out all the organic matter and the nutrients. Because nutrients are going to harp on organic matter why, because of virtue of micro organisms, is this funda clear forever you will remember this excellent. So the point is that the fresh organic waste when it comes in contact with air and in the presence of bacteria, the decomposition starts and after decomposition what will happen.

When soils get decomposed, they get converted into hummus, you remember we talked about hummus organic matter, is this is fine, have you understood the whole thing. As a civil engineer, as a geotechnical engineer, I will hate to have this material in my system. So what will happen, when I practice geotechnical engineering, I will make sure that I will bring the soil to the lab, put it in the oven, get rid of this portion and then I can control other things better

So most of the time organic matter is determined by putting the soil mass in an oven, heating it at 100 degree, 80 degree, 70 degree, getting rid of all those things and then analyzing them fine.