Drilling and Blasting Technology
Prof. Kaushik Dey
Department of Mining Engineering
Indian Institute of Technology, Kharagpur

Lecture – 03
Rock Formation

Let me welcome all of you to the third lecture of Drilling and Blasting Technology.

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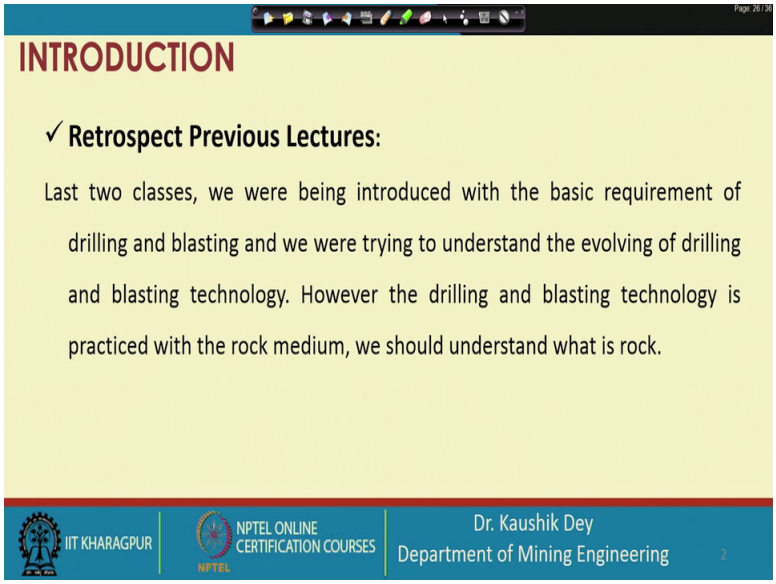

In fact, in our last two classes we were being introduced with the basic requirements of drilling and blasting. We were trying to find out why we were carrying out drilling and why were we carrying out blasting, how those technologies are evolved and how we were carrying out those things for basically fragmenting the rock.

So, if you were considering this drilling which is carried out for placing the explicit inside the rock, blasting is carried out for fragmenting the rock. So, for both the cases basically rock is the media. That means, we are utilizing some tool it may be a drilling tool or it may be an explicit tool for doing something with the rock.

So, basically rock is the medium which is subjected to receive the energy from the drill bit or energy from the explicit. So, basically we are drilling with the rock and that is why I feel it is essential from our side that we should fragment the rock.

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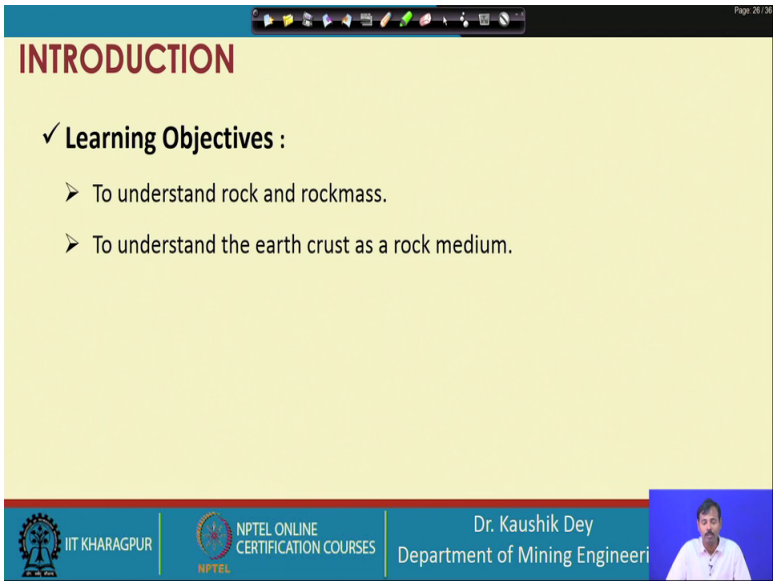

So, what is our learning objective of this lecture? Our learning objective is that we should understand what is rock and what is rock mass, and we should understand what is earth crust as the rock medium; So, basically this rock is the natural substance, this natural rock is naturally occurring in to the earth crust and we are trying to excavate this for our mining purpose, for our excavation purpose using the drilling and blasting technology. So, we should understand what is the rock and for understanding this we should have some knowledge about the earth also.

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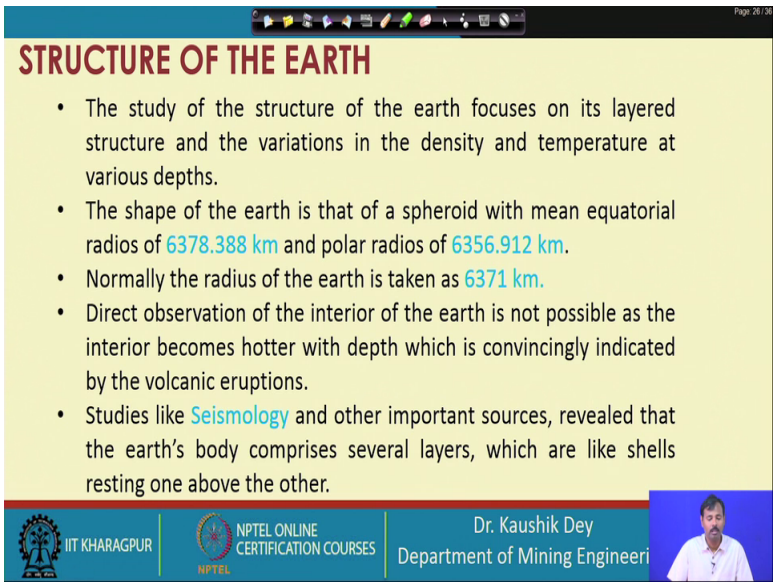

So, basically if you are considering the structure of the earth and the structure of the earth focuses on its layered structure. So, if you are looking into the earth basically earth is having a layer by layer and the variances in the density temperature or existing for all the layers as per the depth.

So, as we are staying in the surface our temperatures are more or less similar to the atmospheric temperature but the movement we are trying to going deferent defer the temperature are varying. Similarly the density of the rock medium is also varying. The shape of the earth is called spheroid, the reason is it is little bit larger in the equator site then the polar site. So, if you are considering the diameter radius of the earth we will find out it is say at equator it is 6378 kilometer whereas, that polar it is 6356 on an average, if any time nothing is given we consider around 6370 kilometer as the earth radius.

So, direct observation of the interior of the earth is not possible if you go through the internet a knowledges about available in the internet, we will find out the deepest hole which is made by the Russian people is approximately of 15 kilometer or something like that. I may be a not in a right point to tell you the right value but it is similar to that. If you can go through search in the Google you will find out that is the deepest man made whole carried out in the earth crust by the Russian people that is for experimental some purpose. But the whole is stopped for further drilling and all the experimentation of the whole is also stopped.

So, that is the in fact, we will discuss we have discuss that in our previous drilling lecture also. So, that is the we have the accessibility only up to that depth beyond that depth with do not have the accessibility, but the interior is no doubt is very very hot and with the depth which is convincingly indicated by the volcanic eruption. So, volcanic eruption which are coming out from the deep core of the earth is showing it is very very hot. Also we have carried out such a seismological studies that also indicates that the earth body comprises of several layers and there are several difference density materials are existing in those layers.

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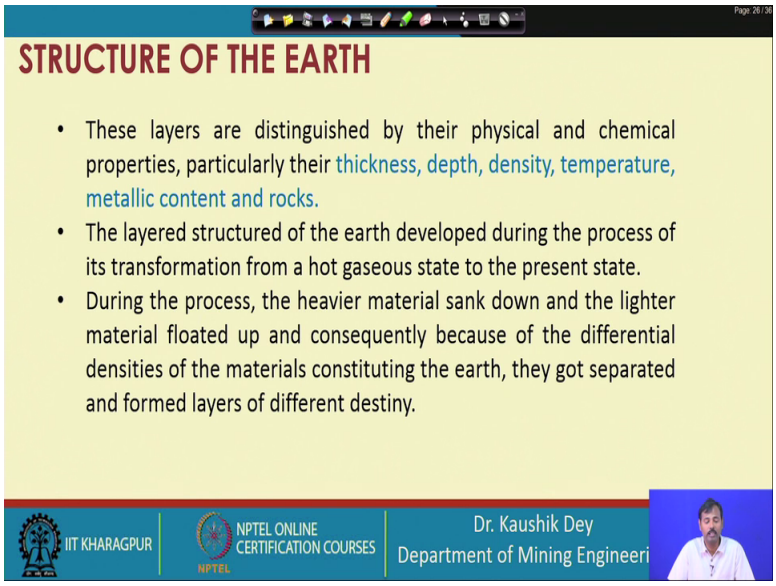

And you can see these layers are distinguish by their physical and chemical properties particularly the thickness, depth, density, temperature, metallic content and rocks. So, basically the layers are existing in the earth crust they of different types of nature. The movement some earth quake occurs the soakers troubles for generator from the earth quake troubles through this layers and we are getting some indicative knowledges for those for those layers.

The layered structures of the earth developed during the process of its transformation, from the hot gaseous state to the present state. During this process the heavier materials are sunk and lighter materials are floated, and consequently differential densities material you can find out the density of the earth crust is lesser than the center of the earth. In fact, some places it goes in to the density of 1820 something like that.

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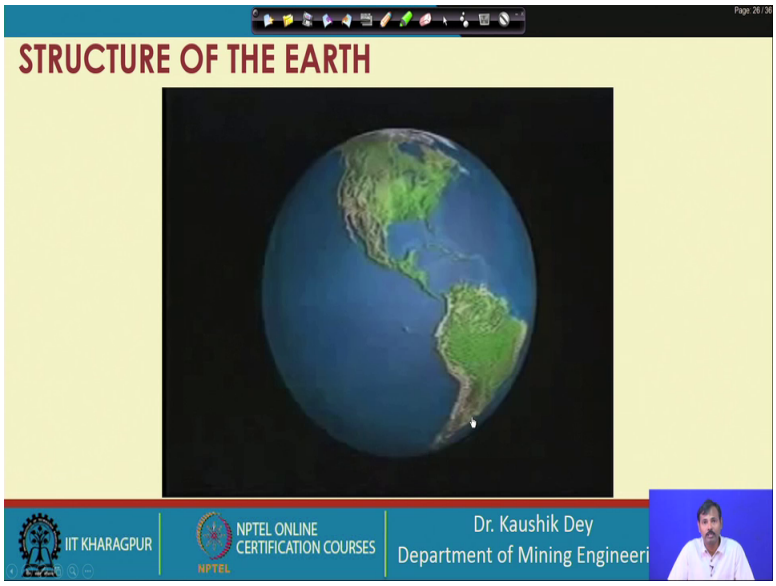

To understand the structure of the earth let us see this video which is downloaded from the YouTube. So, this will give you a better understanding of about the earth crust.

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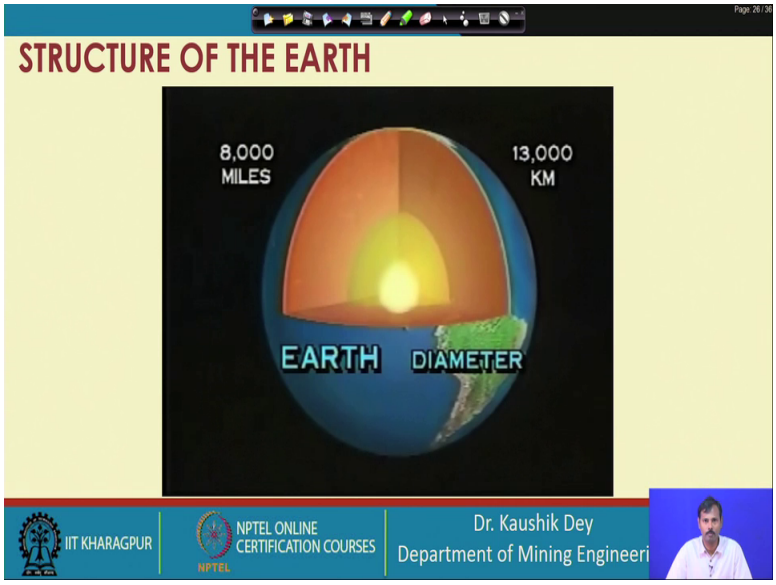

We can spread of out when earth planet we would see where it is made up of various zones. Here it is the (Refer Time: 06:59) 8000 miles or 13,000 kilometer in diameter from the North Pole. It is said the section of the earth crust.

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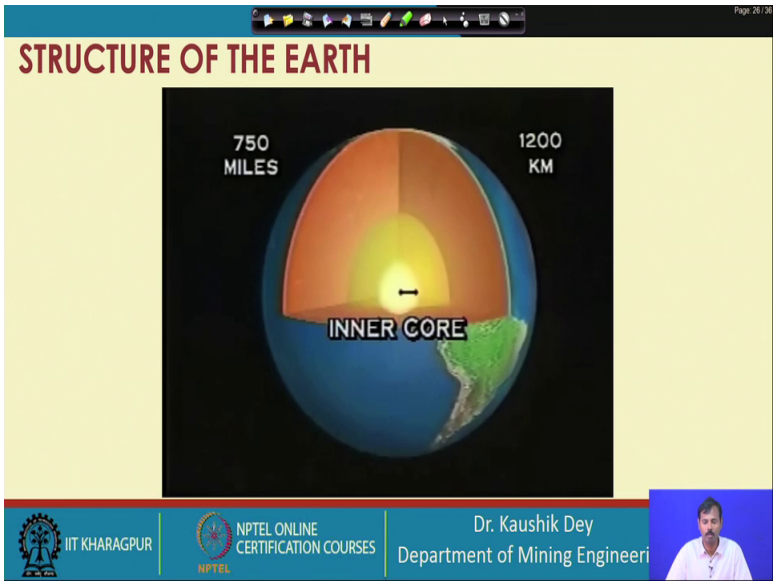

The inner core it is thought to be a solid metal ball about 750 miles for 1200 kilometer thick. This (Refer Time: 07:20) core. It is 1200 kilometer.

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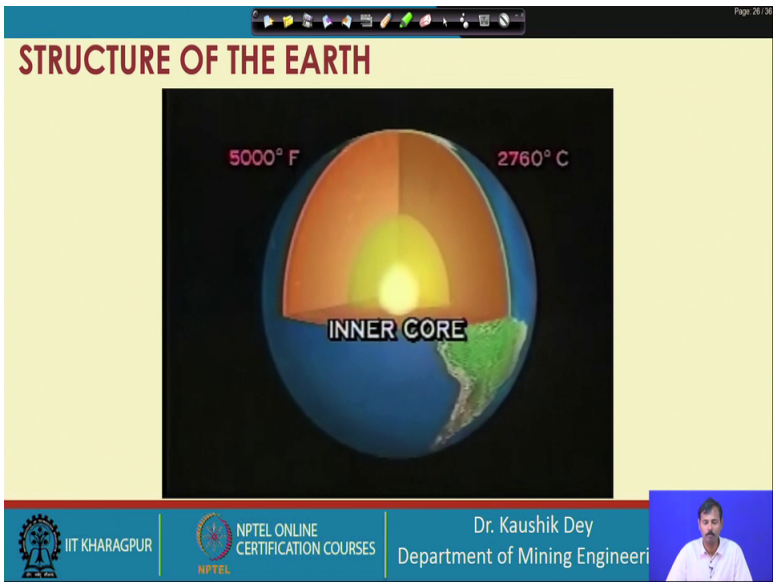

Here raised 5000 degrees Fahrenheit for 2760 degree Celsius.

2760 centigrade temperature.

Surrounding the inner.

Estimated.

Core is the outer core.

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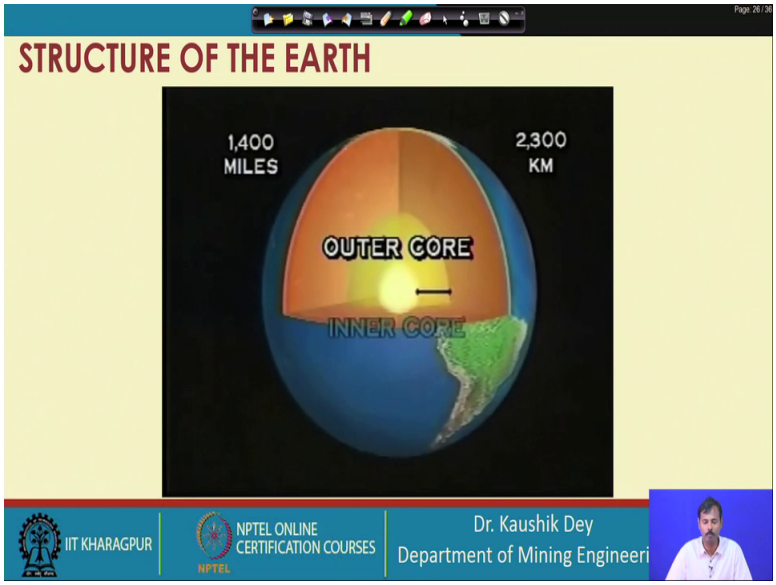

Then the outer core.

This (Refer Time: 07:36) is about 1,400 miles for 2,300 kilometers.

Which is around the further 2,300 kilometer after inner core.

And it is (Refer Time: 07:40) to be both in or a liquid or iron are probably the main elements (Refer Time: 07:47). Next is the mantle (Refer Time: 07:52).

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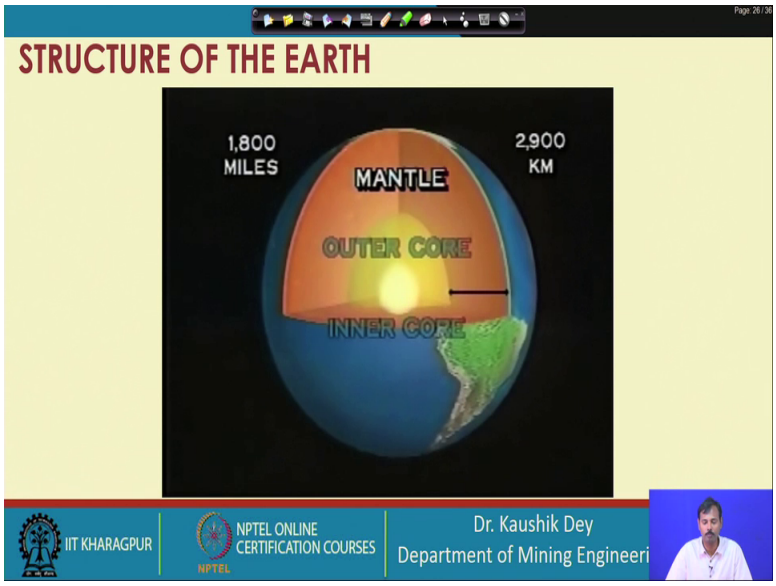

The next is the mantle which is around 2,900 kilometer after outer core.

Most of the mantle is solid block. However, towards the top of this layer where exists a layer of earth (Refer Time: 08:06).

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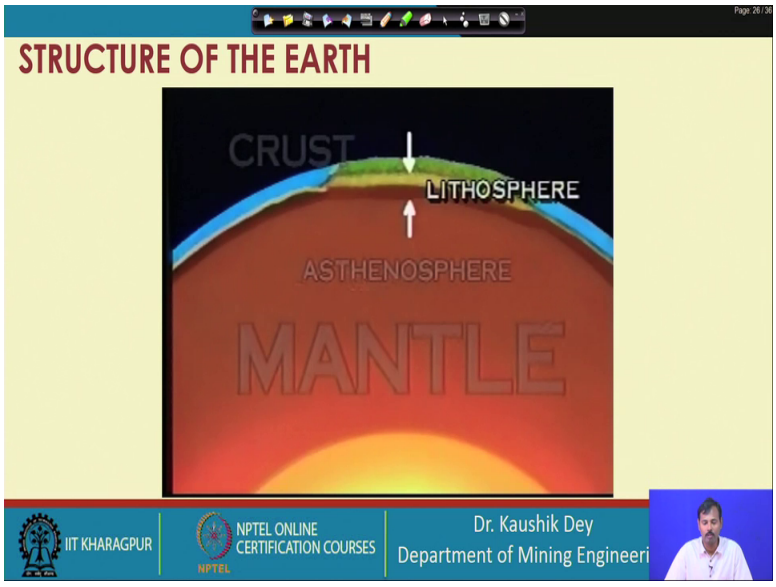

(Refer Time: 08:08) the inner core or outer core are almost in mantle stage. Mantle can be a also (Refer Time: 08:16).

Cool and rigid (Refer Time: 08:16) which we call as crust.

A different layers are (Refer Time: 08:20) mantle different one. So, finally, after mantle it is crust, earth crust which is a very sallow one.

Take a closer look at diagram we see that the (Refer Time: 08:31).

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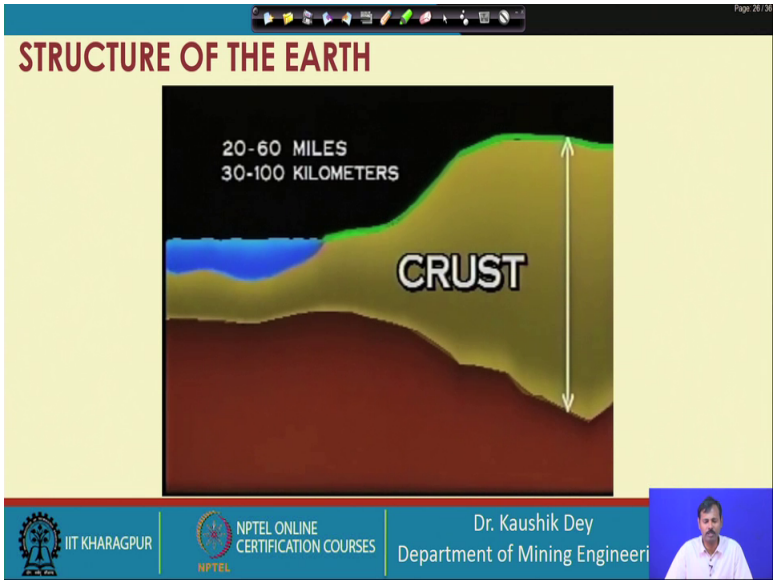

So, the lower part of the crust is called 20 to 60 miles or 30 to 100 kilometers thick. Or sometime it is earth crust is varying from 60 to 100 kilometers.

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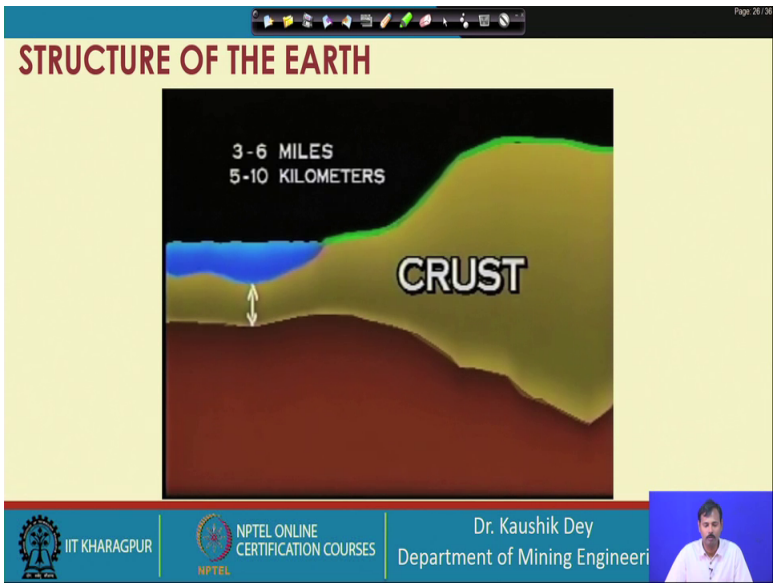

The rock very similar to the common rock, make it a most this section of the crust and under the ocean the crust is a much a thinner layer of rocky material similar to the soil. This section of the crust is approximately 3 to 6 miles or 5 to 10 kilometer thick.

So, I think you have understood: what is the composition of the earth crust.

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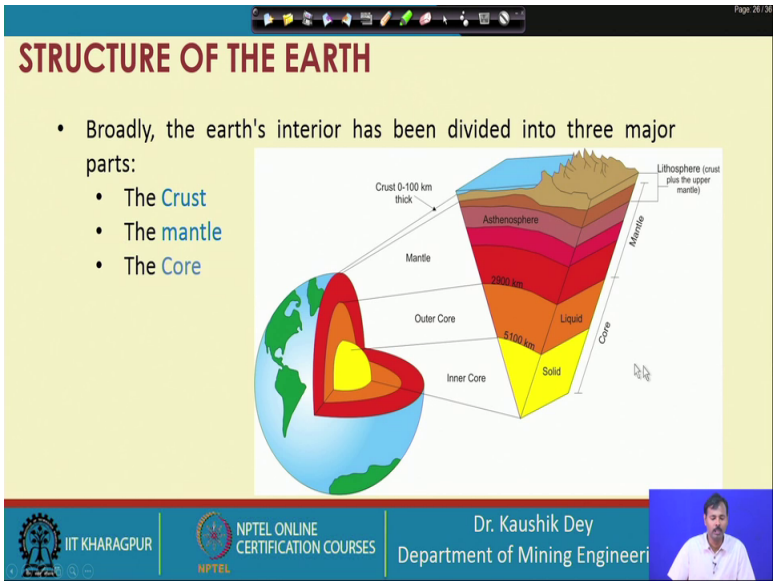

Now, let us see once in a once again. So, the earth interior is showing as the core this is the inner core then outer core then the mantle this portion is the mantle, and then the crust part where we are having different formations.

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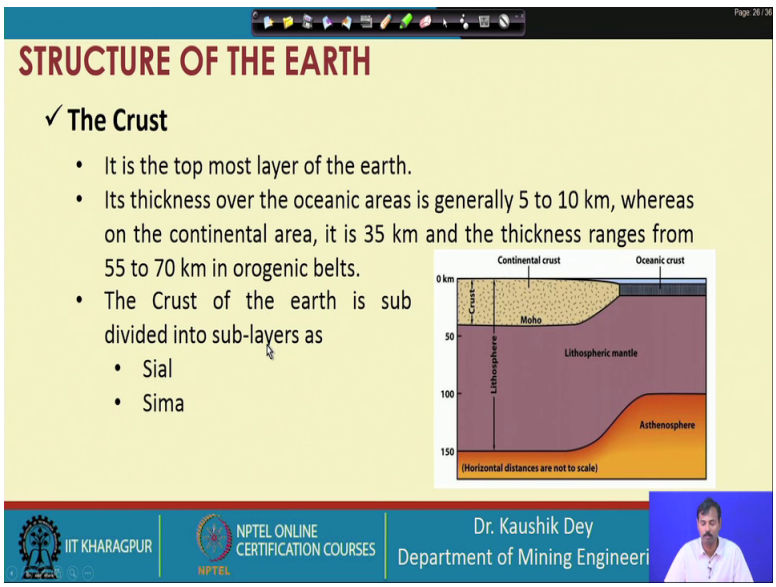

So, our activities are limited to earth crust only so, which is of our point of interest. And you can see the crust is the top most layer of the earth is thickness 5 to 10 kilometer, on the continental area about 35 kilometer sometimes it is it goes up to 55 to 70 kilometer also ok. So, that is available in the earth crust portion. And the most mostly the crust of the earth is sub divided into two layer, one is sial and another is sima.

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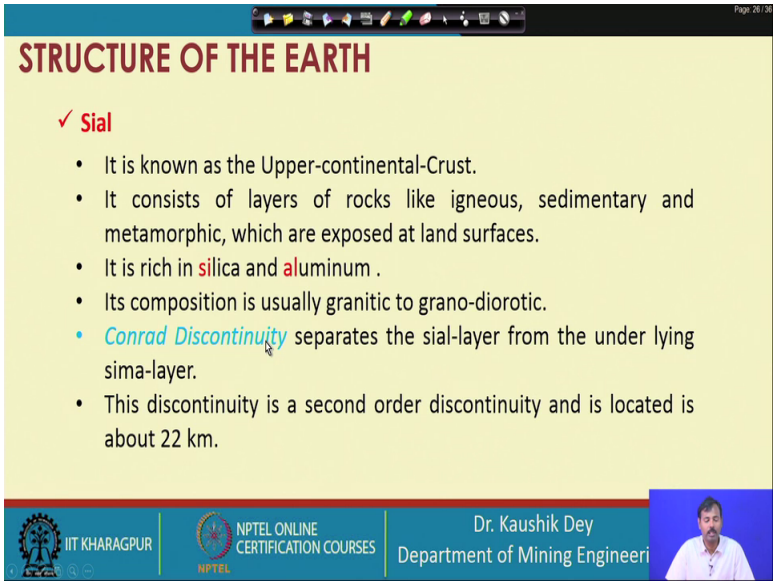

Apart portion of the earth crust is consider called as sial. Sial basically consists of rocks like igneous sedimentary metamorphic rocks. So, sial part is of mostly the lighter weight material. So, it is basically the basic element is silica. Basically the evolve is from the igneous rocks then the igneous rocks converted into different other rocks. So, the composition is usually granitic or grano diorotic.

A sial layers basically conrad discontinuity separates sial layer from its under lying sima layer and this discontinuity is a second order discontinuity and this located is about 22 kilometer. So, basically our operations are limited in the sial part when if you see our activities in sima part is not at achieved. So, most of our activities in the earth crust is limited to the sial part only.

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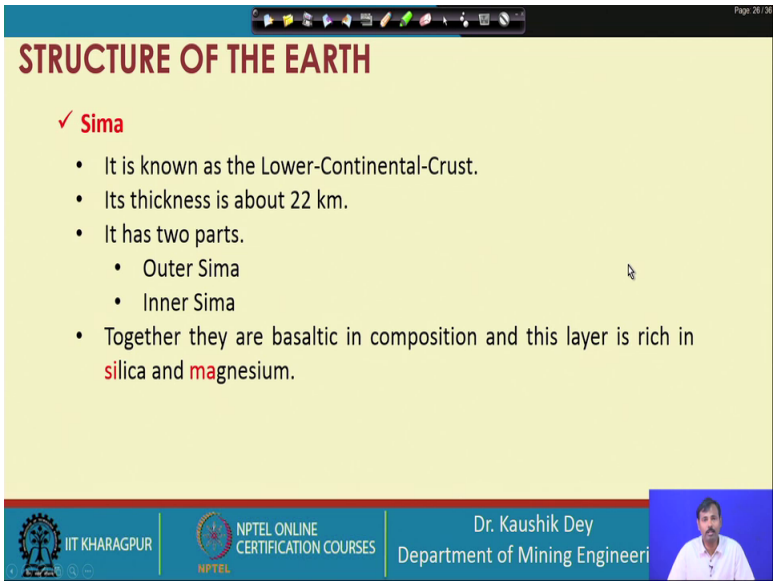

Sima part is the lower layer of the earth crust low this is also called lower continental crust its thickness is about 22 kilometer and it is also having two part one is outer sima and the inner sima. Inner sima is the inner once adjacent to the mantle part; outer sima is a adjacent to the sial part. And there basically basaltic that means, the density is little bit higher if you are considering of the sial part, and this layer is rich if the silica and aluminum like sial part it is silica and aluminium. In this sima part it is silica and magnesium.

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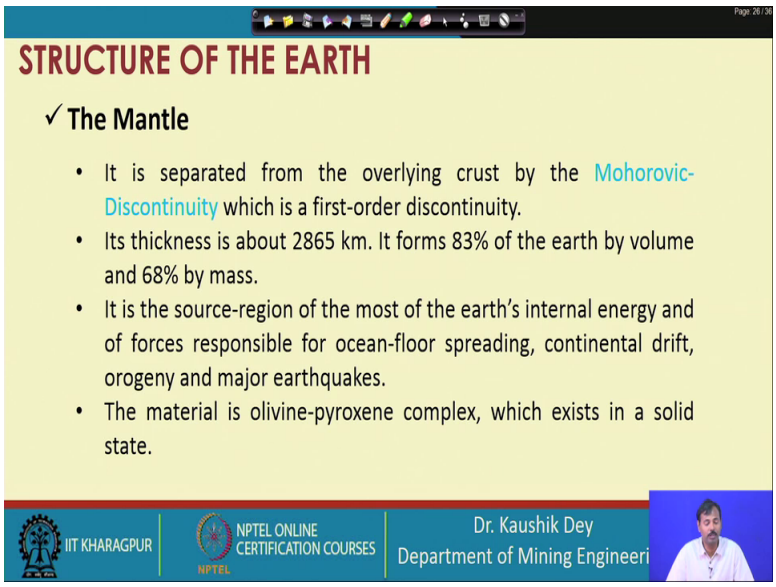

Then the mantle part basically, the seismic activities are mostly carried out in the mantle part, reality is sometimes is carried out in the sima part also, but mostly it is carried out in the mantle part is this seismic activities. And this mantle is basically separating the crust from the inner or outer core. And mantle is separated from the crust with a mohorovic discontinuity which is a first order discontinuity. The mantle is having a thickness around 2,900 kilometer.

Mantle is some major part of the earth which is consider which is comprising around 83 percent of the earth volume and 68 percent of the mass. So, mantle part is very very important then basically mantle part is creating the mantle part is basically having those tectonic activities.

It is the source of region of the most of the earth internal energy and those energies are often realizes with the tectonic activities. It is also responsible for the ocean floor spreading, continental drift, major earth quakes the mat most of the material comprising it is the olivine pyroxene materials which existing solid a state in the high temperature also.

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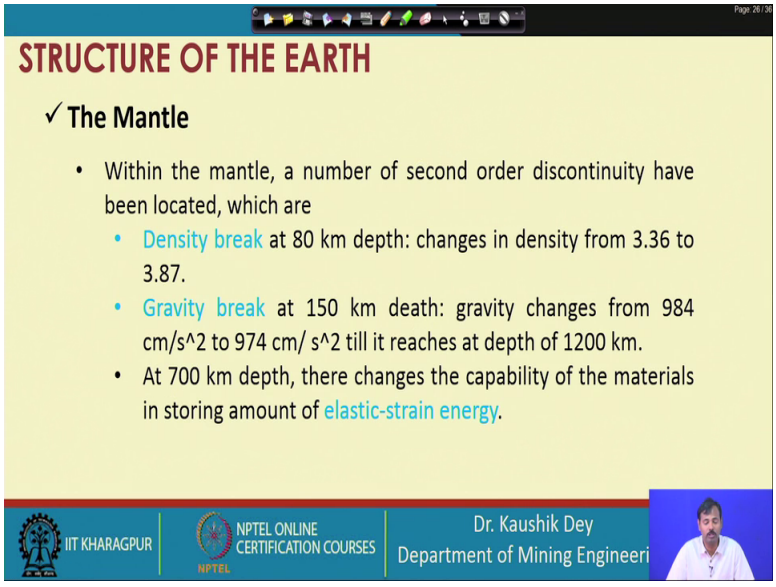

Within the mantle a number of second order discontinuity are also there and often this a stresses are build up along this discontinuities and with the breakage of those this the energies are realized. Density break 80 kilometer of the depth changes the density from

3.3 to 3.87, 87, where the earth crust our normal density is varying around 2, 2 to 2.4, in the mantle this density reaches up to a 3.3 to 3.8.

Gravity break at one point 150 kilometer depth. So, gravity changes from 984 centimeter per second square to 974 centimeter per second square, it reaches depth of 1,200 kilometer. So, at 700 kilometer depth they are changes the capability, capability of the materials in storing about elastic strain energy.

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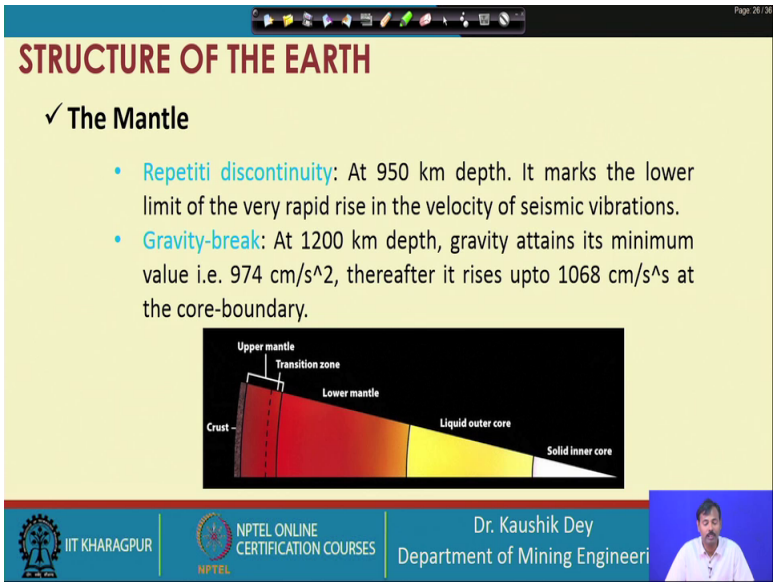

So, that is why these mantles are very very a significant one which basically produces the earth quakes and different release of the different seismic energies. And 950 kilometer depth it marks the lower limit of very rapid rises in the velocity of seismic vibrations and 1,200 kilometer gravity attains its minimum value of 974, thereafter it rises 1068 centimeter per second square at core boundary.

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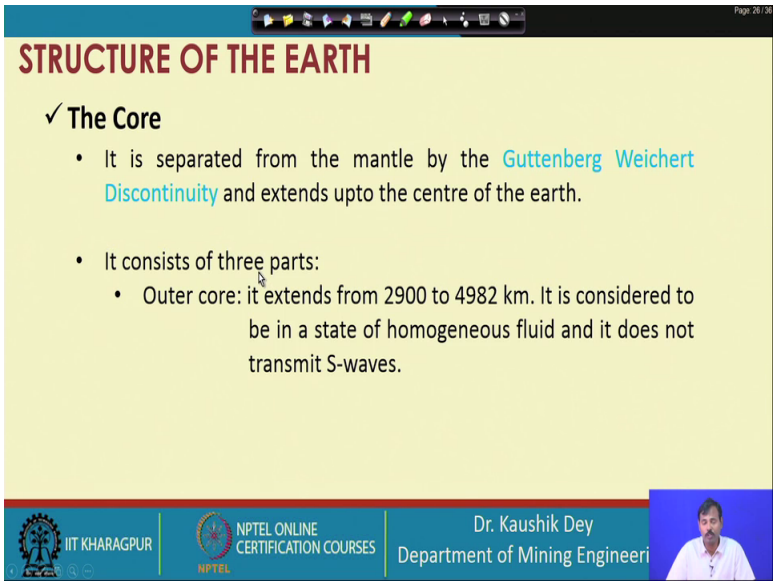

So, that is why this mantle part which is important for seismic activities but not of very much interest to our part, our rock excavation is limited to the outer core that is the sial part of the crust only.

So, the core for our sake of knowledge let us understand, the core is separated by the Guttenberg Weichert discontinuity and this it is the core is consider up to the center of the earth. And the outer core is 2,900 kilometer to 4,982 kilometer depth and it is consider to be a state of homogeneous fluid that is why the seismic wave the body seismic wave S-wave, CR-wave does not troubled does not transmit through this medium. It transmit through the outer medium only, however P-wave may travel from this medium.

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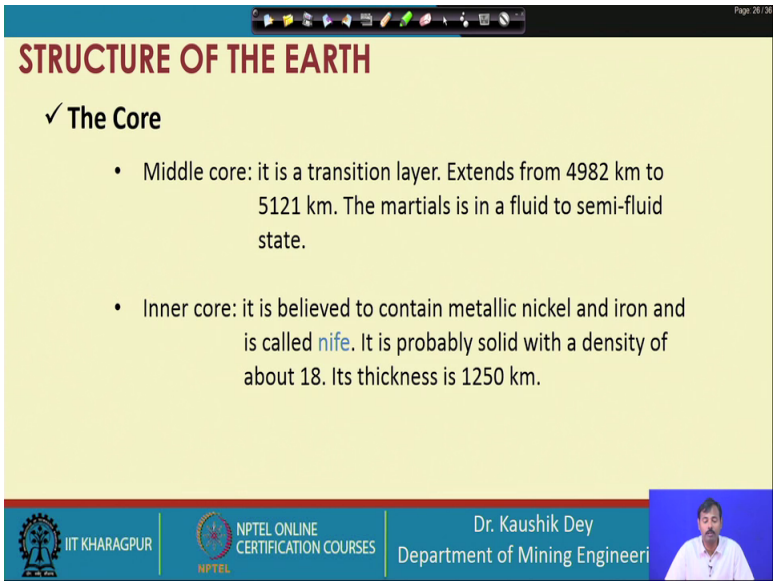

The middle core is existing around 4,900 kilometer to 5,100 kilometer, and this is in semi fluids fluid or semi fluid state. And inner core is very very in fluid state and often the density of the inner core rises up to 18.

So, inner core is called nife and its thickness is believed to the 1,250 kilometer. So, basically this is the comprising of the earth. In the next class will discuss about the geology of the rock. So, the understanding of the earth is basically showing us that all our activities that limited to the crust of the earth and that is also the outer crust of the earth which is consider called as the sial. So, on the very surface part where the densities low on that part only we are carrying out our rock excavation activities.

So, we will understand the rock and rock geology in the next class.

Thank you.