Principles of Casting Technology
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Lecture - 12
Technology of Coremaking
Cores

Welcome to the lecture on Technology of Coremaking. So, in this lecture we will discuss about cores - why cores are used? What are the different types of course? What are the processes of making course, all that, we will discuss in this lecture. So, we know that in casting if we have to make internal cavity, we have to use cores. So, cores are basically the materials used for making cavities and internal features which cannot be produced by the pattern alone.

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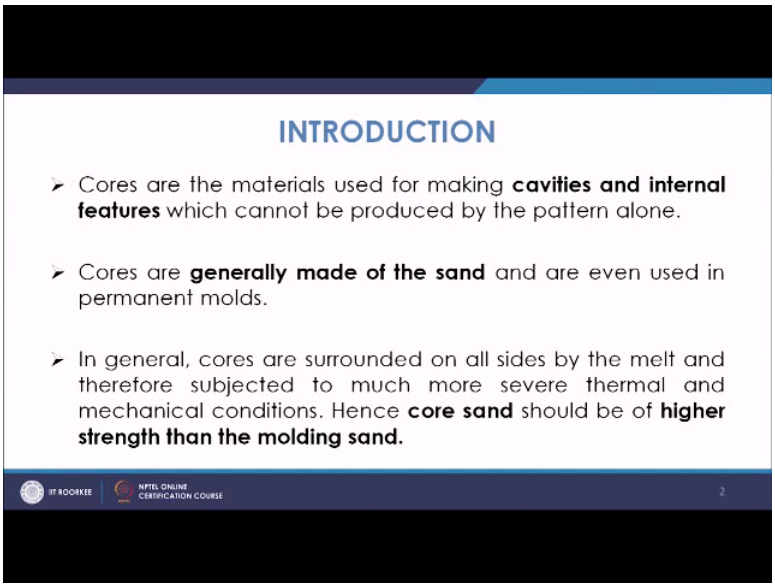

So, pattern gives the overall cavity of the casting whereas, if suppose you want to have a drilled whole in the casting, in that case and if it is not possible to have the pattern because, we can have something there, but then the problem of withdrawal may be there. So, in those cases we use the cores. So, cores are nothing but there will be sand or metal portion in that place. So, that when metal is poured at that place there will be no metal, so basically that that will be a wider space. So, this how cores are used.

So, normally they are made of sand and you have a separate section of core making. But even we use the permanent molding materials like metals and alloys, but since the collapsibility of these cores is not there permanent mold materials like metals and alloys, with their restricted to their shapes, so we use the sand. Now the cores are basically subjected to more abuse by the metal because they are surrounded on all these sides by the hot metal. So, you need to have core made of sand of special quality or a better quality, then that can be used for the mold making because it is from all this sides it is in contact with hot metal and it has also to evolve the gas says it has also to release the gas says it has to be permeable, it has to have a high strength, it has to have a high hot strength. So, all these properties are required in the cores. So, basically they are subjected to more severe thermal and mechanical conditions. So, that is why they need to be having high strength than the molding sands.

So, in this sand basically, we have to maintain high level of purity. So, that your refractoriness level is higher, you have also to see that is not fuse because if they fuse on the surface it will we directly affecting the quality of the surface on which there is fusel and that will completely affect the internal feature and it will lead to rejection of the casting. So, there are many qualities if core must have which we will discuss as the time to basis.

What are the desired characteristics of a core? So, as we have discuss the molding sand, which have the desired characteristics similarly for a core also you have some qualities which a core must have or a material by which we have making a core it must have.

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So, in that there is green strength, as we know green strength is that strength of core by which you can make the core and it can with stand its own shape and size or its own weight. So, when you we are making the core and we are in the process of making core and we are adding the binders and additives in to the core and then we are trying to give it a shape at that time this is the strength, by which it can have I mean strength. So, that it can with stand its own weight and be in the proper shape, dry strength is strength when it is dried at that time its strength is known as dry strength.

So, that it can we stand the pressure of the metalitive subjected to, permeability is a again the same property by which it can allow the gas is to kept through it refractoriness is a same again to which stand high temperature, without fusing collapsibility cores also lead to be collapsible. So, that after solidification it does not interfere, with the metal it is should have the scratch it is should collapse easily, so that is you can remove it easily. Smoothness is the surface of the core must be smooth, because that smoothness will only be reflecting on the cavities surface. So, smoothness it must have and for that you must have proper green shape and size and proper binders, so that it gives smooth finish and you may have to do some finishing operations before you put the core into his place.

Friability is the ability to crumble, I mean automatically should crumble once you are trying to remove the cores, you are knocking out the cores after the casting has solidified it should crumble easily, if it does not crumble easily it may lead to so you may have to

hammer it, with large force and in that case it may do you may end up in damaging your casting. So, basically this is the ability of crumbling itself.

Low gas emission, now the cores are basically subjected to the hot metal from all the sides and if there is moisture and there will be in that case it must be able to exhaust all the gases, which are generated inside the core and it must have a good and the thing is permeability that is permeability, but low gas omission means, but the gas which is emitted it must be minimum. So, that is the requirement for a core if it emits large amount of gases because of the presence of moisture or other volatile substances in those cases the gas emission although should be maintained to be minimum. Now core making practice, so how we make the cores? Now in the while we use the pattern to make the cores pattern is placed over core box filled with stand inverted and baked.

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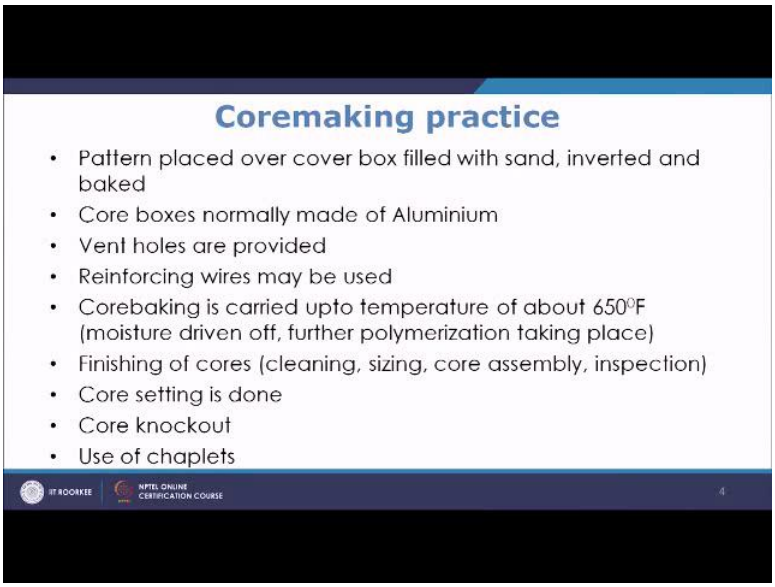

So basically once you have the pattern for making cores you make the core then cores are basically baked so that a large strength is developed. Core boxes, so for that you have the core boxes especially, design boxes are there and since they are to be baked. So, normally they are made of aluminum. So, core boxes are normally made of aluminum. You provide the vent holes so that when it releases while baking whatever gases are formed they are released from the cores. You also reinforced with wires so that it gains large strength when we place in the metal and when it has the sagging tendency or it when it is subjected to metallic static forces, that time to with stand that forces

sometimes we do the reinforcement of the core with wires. Then core baking is carried out up to temperature over 650 degree Fahrenheit. So, basically once we make the greens and cores or cores, which is having the binder then we need to bake it. So, that is strength is increased.

Now this baking is done up to temperature of about 650 degree Fahrenheit. So, in that basically initially, when you go up to 212 degree Fahrenheit or the volume point of water, that is 100 degree centigrade. During that process once we hold it sometime may be one hour, all the moisture is driven off after that about up to 500 degree Fahrenheit, due to this heat the polymerization taking place in the core making we use organic binders we do not use the clay, because there are some reasons for that we will discuss. So, the strength which is developed during baking is because the polymerization process at this higher temperature above of about 500 degree Fahrenheit and then we will go further up to 260 Fahrenheit.

And during that process, the core develops adequate strength. So, that is baked strength, once we have the core bake, we have to do the finishing of the cores. So, we have to see that core has a proper finish it has been cleaned on the surface it is of proper size, proper shape and further that is done by inspection of the cores that when we have to put it in the cavity, than it must be of adequate shape and size and proper finish. So, put in the core at its place that is known as core setting. So, this practice is known as core setting when we keep it at a particular place. Then core knockout, so after the solidification basically core have to removed, so that is this practice is core knockout.

Use of chaplets, so this chaplet is basically use to support the core its take care of the once you forces which the core experience. So, that will be discussed later. Now core sand ingredients, so in the core sand basically we have sand grains binders and other additives just like in molding sand, here also you have core sand and then you have binders and binders so that the sand is mixed properly and they have the cohesiveness property and then you also add additives, which provide the specific properties.

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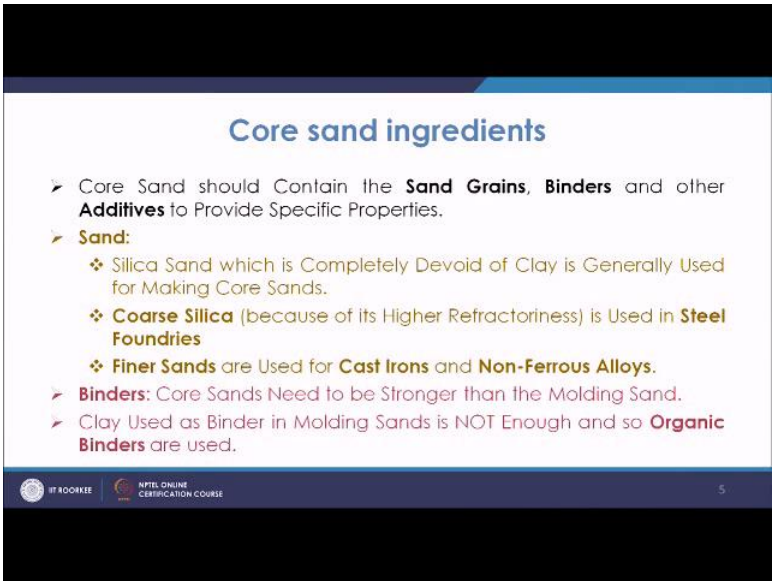

So, if we talk about the core sand basically the sand should be the pure sand having good purity silica sand, which is completely devoid of clay. So, silica sand which has the highest priority that must be used, clay should not be there in that sand, because the clay basically increases the consumption of the remainder and also clay has less refractoriness. So, this are the two reasons why it should be not having any clay, core sand is used for steel foundries because the core sand has higher refractoriness and the steel foundries were you required higher temperature to cast the metal. So, you use the cores core silica sands for making the cores, were as if you are to cast irons or non-ferrous alloys in cast irons.

The melting temperature includes 1140. So, there or in non-ferrous alloys were it will be for copper or for aluminum or for any other non-metal, which is even lesser then that of cast iron. So, here you can use the finer sands. So, this is how, you have to see that how you have to use the different sands of sizes for getting the cores. So, that which stand higher temperature, binders this core sand needs to be stronger then the molding sand. So, binders which are used are the organic binders, clay is not used as a binder in the core sand or core making by sand, because of many reasons and one of the reasons is that even use of clay has binder does not produce enough of strength, which should be able to sustain the matrostatic or thermal conditions, under which the code is subjected to. So, normally we use organic binders.

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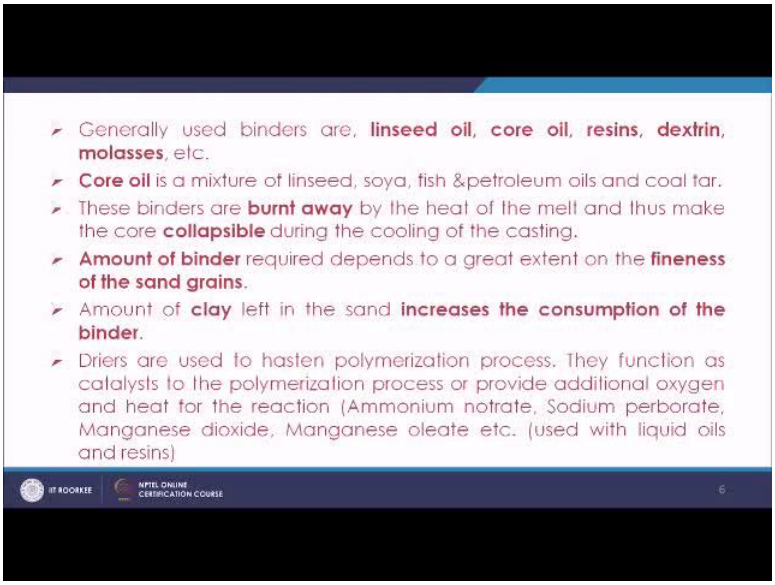

The generally used binder, are linseed oil core oil resins dextrin molasses etectra. So, these are the general used binders core oil is the mixture of linseed soya fish and petroleum oil and coal tar. So, basically this is the organic binder that is used for making the cores. So, these binders basically are burnt away, by the heat of the melt and make the core collapsible during the cooling of casting.

They first of all it gives larger strength, because giving any organic binder strength develop this because the polarization and then there are also burnt away by the heat and then they give the collapsibility, because they clear the voice phases which help in giving the collapsibility property to the core. Amount of binder required depends to a great depends to the great extent on the fineness of the sand grains. So, as the fineness of the sand grains will be more and more the amount of binder required will different (Refer Time: 15:39) it will increase basically also if the clay is there clay basically binders. So, that way having the clay is deleterious, because it increases that consumption of the binders. So, we should see that minimum amount of clay is available in the core sand.

Then we have driers which are used to hasten polymerization process. So, they are also working as the catalysis to polymerization process or provide additional oxygen and heat from the reaction. So, we also use certain driers like aluminum nitrate, sodium perborate, manganese dioxide, manganese oleate etcetera. So, they are basically used with liquid

oils and resins in that case we are using the driers to so that this polymerization process takes place hastily and then we more heat generated and strength develop early.

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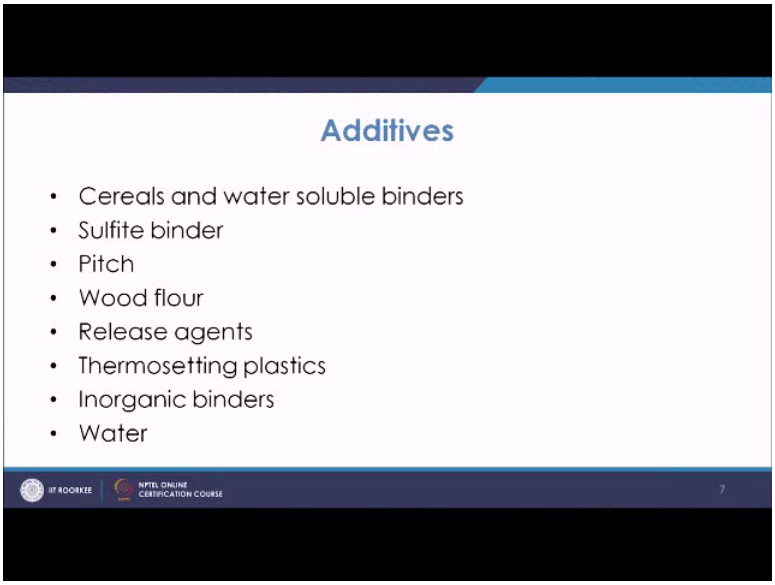

You have different types of additives also used cereals and water soluble binders they increase the green strength of the core. You have sulfite binders, pitch, wood flour, release agents, thermosetting plastics, inorganic binders and water. So, this are the different binders, this are the different additives, which give the specific properties like you have some hot strength development by using the pitch, you have the wood flour which is use for giving the collapsibility, you are the release agents which are used. So, that the flow ability characteristic are increased thermosetting plastics are also used because they are giving the strength to this.

Core sands or that mass inorganic binders are also some sort of clays (Refer Time: 18:04) clay are also used and then water which is already they are water as such is not used, but this water is used which is already there in the binders, which we used 2 to 5 percent of water, is there if you use more water then we the stratification of water and that will basically affect the quality of core which we are going to use. So, these are the normal additive, which are used in the process of core making. Now, if we do not make the cores of proper size or in proper manner, then there may be different types of core defects.

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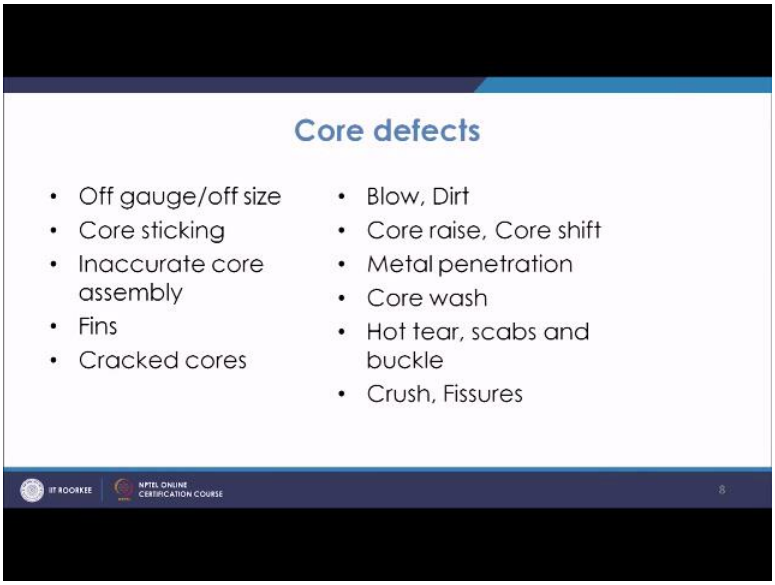

Now this core defects are like off gauge off size. So, it may be of different size not proper size core may be sticking because of the different surface characteristic to the surface of the metal and then it will be difficult to remove the core or sticking to the core boxes were your making so that is related to that process were its stick to the core boxes. In accurate core assembly then fins cracked cores, this are so you may have the surface appearance like you may have generation of fins or you may have the cracked cores these are the types of defects which are encountered, while making cores that may lead to having the blow or dirt; blow is nothing but the gassiest type of defects because of the large amount of gasses being generated that may lead to blows inside the casting you may have dirt because if there is loose sand if there is no proper finish that may go into the castings. So, that may be dirt you may have core raise core shift.

So, core may core may go at a higher place because of the blow see and may if not properly supported, then it may lead to this problem of core raise. So, that will basically change the dimension of the core or the cavity which we are going to make or it may be out of place. So, that is core raise core may be shifting. So, that is also going to be because of the improper positioning of the core it may go one side of other, because of the metallostatic pressure if not properly first and to its place or properly seated to its place so that may come.

There may be metal penetration into the core depending upon the surface quality of the core. So, in that case there may be the different appearance or there may be affected surface finish of the casting, because of this I am qualities of this cores, you may have the defects like hot tear scabs and buckles these are these are the basically defects may be because of the stresses generated, because of the stresses generated at the corners or because of the quality of the core surface by because of is there cracks generated. So, these are the casting defects which can occur because of cores you may have crush or fissures.

So, these are the different types of core defects, which are likely to come if the quality of the core is not maintained properly. So, we have already studied about the different types machines which are used in case of core making like jolt, jolts squeeze, slinging or so or core blow are. So, these are the different types of machines which we are discussed earlier when we used to make the cores. Now we discuss about the types of cores. So, what are the different types of cores which are used in the foundry practice?

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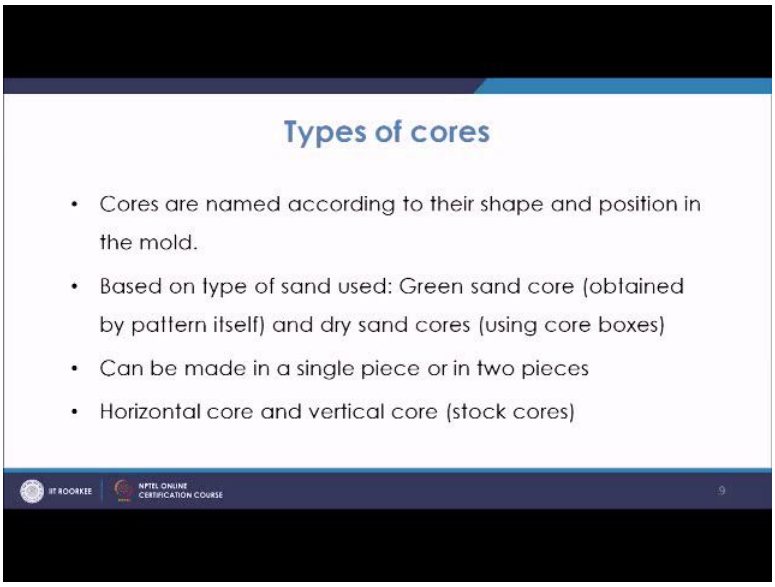

So, cores are basically named according to their shape and position in the mold. So, different type of shapes at different positions we use the cores based on that, you we give the different names. First of all depending upon the type of sand used we may have green sand core where the core is made of made by using the pattern. So, that type of coring known as green sand core. So, where you are making the mold cavity, that time with the

pattern itself you make the core. So, that the core is made of the green sand and once we pour into it i will work as the cores and you can get the cavity at that places and if you use the dry sand, then it is known as dry sand cores which is basically use for making the cores in the core making stock and their we use the core boxes. So, that is why we have green sand core as well as dry sand core.

Then you can make the core in a single piece using split type of core boxes or you may have the core boxes using the separate core boxes make the two pieces and then these two pieces are made to be joint to each other by using the core gum or paste. So, this way we are making the cores either in one piece or in two pieces and or in multiple pieces and we can make the cores by attaching these different pieces. Depending upon their position in the mold how they are kept in the mold, they are classified as horizontal core or vertical core. So, if it is kept horizontally in the mold. So, X is horizontal of the core then it is known as horizontal core and if it is kept vertically if in the casting you have vertical size of holes, vertical direction of holes in that case and if they are kept in the vertically direction then it is known as vertical cores.

So, basically they are known as stock cores, because normally we use as the horizontal core or vertical cores in general. So, in mass their used and that is why their used known as stock cores because we make the horizontal core or vertical core of different dimensions and then keep in with us ready so that whenever we require we can use them. So, we are also known as stock cores then depending upon the different shapes, we have or its positions we have one is balanced core.

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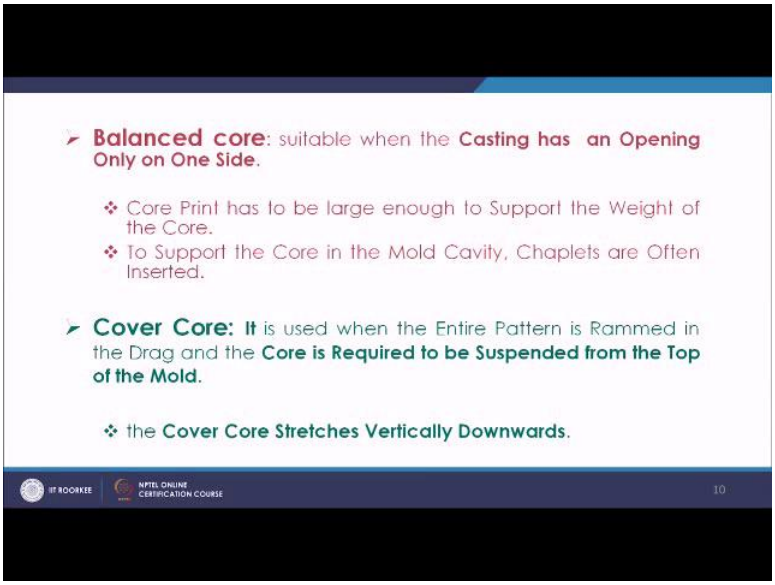

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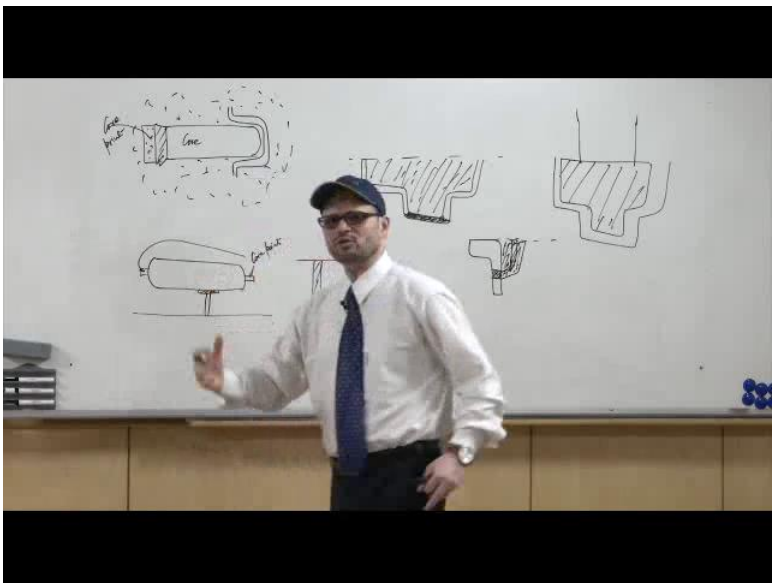

So, the balanced core is by definition it has opening on only one side and it is balanced by having the support on one side of the in the mold. If you have a cavity like this, so if you have to make a cavity a casting like this. So, what we do at this is your molding material, in that case you have a core of this type, which will basically come and then in this side you have the support. So, this is your core and this way you have all this sand and this is supporter we are from by the core print. So, this is core print. So, what we see

is only on this side it is supported and this as, so this way you can get the cavity like this here it will work as the core and this will you have this (Refer Time: 26:21) cavities.

So, this type of cores are used as balanced cores, the which has to be taken in such cores is that you have to make these to core print quite stronger, because it has to sustain the whole weight of the core. So, the core print has to be large and to support the weight of the core and what we do normally is even to keep it on position we may also use the chaplets to support the cores, will study about the chaplets later. Then there is a cover core where the entire pattern is rammed in the drag and the core is to be suspended from the top of the mold. So, basically in that case what happens if you have such cavity, in that case if you have to make like this, now if completely in the drag then this can be your core. So, you may get this cavity. So, completely done in the drag portion and this is just kept. So, because of this core you will have this cavity generated and such cores are known as the cover core. So, it stretches vertically downwards. So, this way you have the cover cores.

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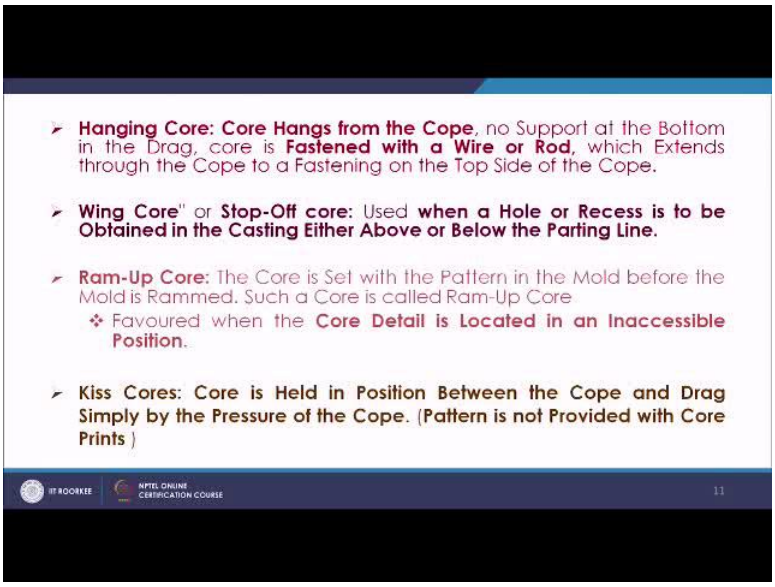

Then hanging core, now what happens sometimes we need to hang it, so no support at the bottom in the drag. So, basically in this case what we see is, this place is basically nothing, here you have metal. So, this way your structural will be like this and here it will be a straight line and then this way it goes. So, it is supported at the bottom, this type of cores have a support at the bottom whereas, when there is no support at the bottom in

that case the same thing needs to be hanged. So, there it is hanging from the top pours or from the cope side. So, then it is known as a hanging core. So, in that case if you have the core like this and you have to make the cavity, now like this in this case this is not the cavity part in the case of cover core, but while he make the hanging core in that case this part needs to be hanged.

So, this is lifted from the side from the top then it is known as a hanging core, because there is no support here, if we do not hang it this will fall here, from then it will be variety of come or core, but when we need to hang it from the top pours on then it is known as a hang in core. Then there is a wing core or stop off core you need to have these cores when a hole or recess is to be obtained in the casting either above or below the parting line.

So, basically what happens in such some cases if you have cavity going like this and you need to have a hole here. So, such holes you cannot make or you cores cannot be placed as such. So, what we do is you provide certain part in such a way that it can be part of it. So, this comes like a surface of this and these cores are known as the wing core. So, otherwise you cannot have the recess here you cannot do the drilling here in the casting. So, you have to have the support on this side. So, that you get a cavity in this portion then you have and say and it make a surface of this casting. So, it goes like this. So, it makes a surface that is why it is known as the stock of core. And kiss cores they are basically held in position between cope and drag simply by pressure of the core.

So, basically pattern is not provided with core print. So, when the pattern is not providing the core print there is no support for the core and the core is to be we have to have the core only between the two boxes and only by the contact they are basically supported, then and there touching these two boxes the upper and lower molding boxes then they are known as the kiss cores, because when there is no such I mean requirement that there has to be complete appropriate size or numbers, then it is known as. So, then we use the kiss cores.

Core prints and chaplets we have discussed. So, basically when we have a core, then we have to have some surface. So, we have to support on the side in the cavity. So, this is the core print and core prints are basically required to support the core on both the sides. So, this is core print and this is core print. So, core print is basically that provides the

core a seat. So, that it can have a seat in the mold cavity whereas, the chaplets are provided at the bottom.

So, chaplets are basically chaplets are there to support the core. So, that because of the metallostatic pressure or because of the bouncy forces this cores do not their shifted. So, basically the chaplets must be of the same material at that of the material because this forms, this is the metal so chaplets will ultimately a fuse with the metal.

So, chaplet where as to be of the same material as that of the metal or in the cast metal, so this way core prints and the chaplets they are different and both solve the function of holding the core its own place in different way.

Thank you.