Geographic Information Systems
Prof. Bharath H Aithal
Ranbir and Chitra Gupta School of Infrastructure Design and Management
Indian Institute of Technology-Kharagpur
Module No. #04
Lecture No. #19
Maps and Numbering

Hello, namaste I am back with the next set of lectures when we would look at the maps and numbering this is extremely interesting for students to look at. Now as I said previously in my the module 2, the maps are available online. So most of few can download maps. there are certain restrictions for download every month but you can download all the maps that are available online. And can use it for deriving a lot of informations.

So, let us look at maps today how are maps represented, what is basically a map, what you should look at a map. If you have a map, what are the things that you have to look at before you start analyzing that particular map. Then how do you identify a map, what is the scale map, how you identify the scale on a map, even without knowing the scale, ok. So all of these are things we would look at in this particular set of lectures.

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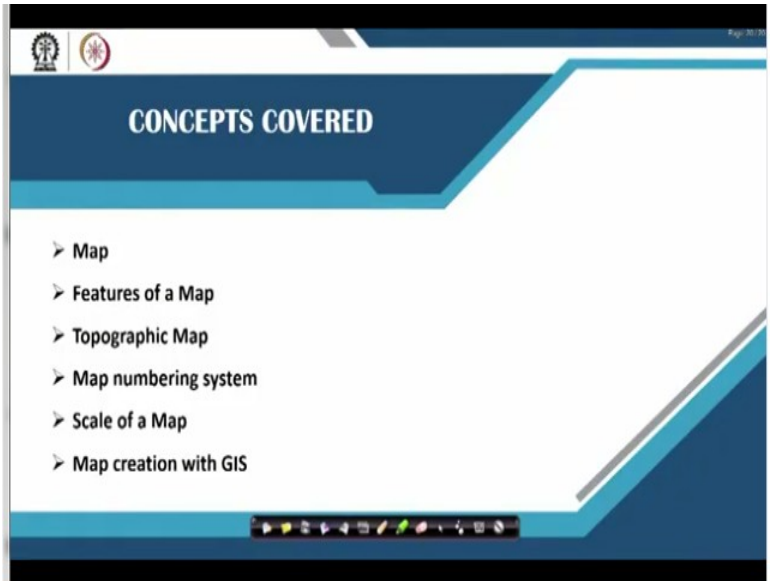

Now as I said we look at the first thing is what is a map. then features of a map, then what do you mean by a topographic map. Then the very important thing is the map numbering system in India and the adjacent countries is the convention that we use for Indian map numbering system

that we would look at this particular lecture. Once we have understood it then we look at what is a scale up a map, how do we represent that particular scale, then map creation with GIS that is what is important.

So, now I am slowly starting with the, how do you actually do an a practical analysis of using a GIS platform. So, if you can understand these it would be easy for you to actually work on a practical sessions when we start looking at it, ok.

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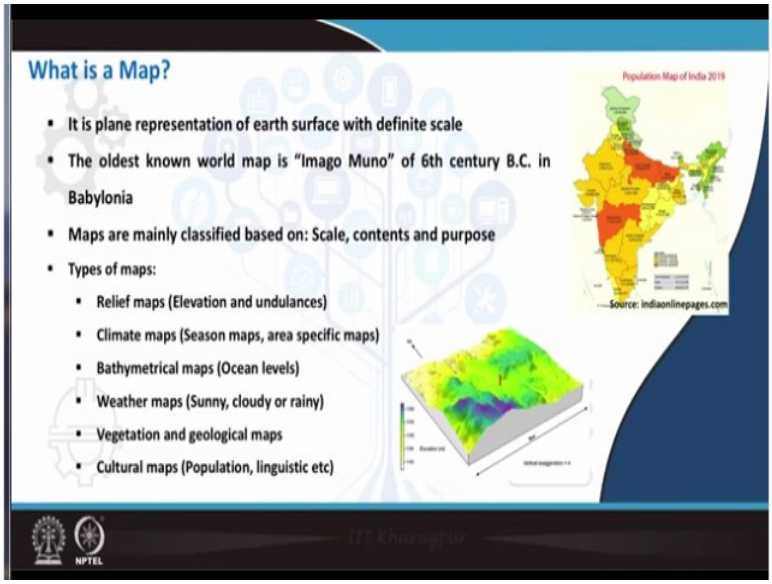

So map, so everyone has an-idea of a map right, so it is nothing but a plain representation of the earth surface with a defined scale ok or it can be representation of the 3D surface of the earth surface into a 2D ok in terms of having a scale a definitive scale. So now when you are looking at map the oldest map in the world known map is image Muno of 6th century B.C in the Babylonia.

So that is the oldest are map that you can see available with us. Then maps are mainly classified based on scale, contents and purpose. So scale defines it different scale of maps are there for different applications, then you have contents in a map for specific applications you need specific contents. And purposes that is the main classification of the map, different purpose, different maps are used.

For example, if you see relief maps. these are in terms of elevation and undulances in that particular region, then you have climatic maps that is based on season based on area and it is very specific. And bathymetrical maps for ocean levels, then you have weather maps like sunny, cloudy or rainy that probably most of few have an android phone. So you keep on looking at it probably when you start from your home or to your officers or to your schools and colleges .

Then you have a vegetation and geological maps representing different aspects on the earth surface the vegetation aspect on the earth surface or the geology of the earth surface. Then you have the cultural maps for example representing a population ok, say representing a population map. So for example that map that is represented here on the screen is nothing but a population map ok.

So, this particular thing is an elevation map or a relief map, it is showing that this particular region has a higher elevation when you see these are the higher elevation and these are the ones with the lower elevation can see this scale here. So this gives you if you for example here that is 1100 meters, the white. If you can see these are the regions which is quite in that.

And you have yellow which is 1160 meters which is here and then you have dark blue, which is the highest point in this particular map which is 1300 meters above the mean sea level ok. So that is what we are and it gives you a vertical exaggeration that is to see what the elevation in a much power much differentiated way, so that is given as for. So I hope everyone understood what is a map there are different types of map, different ways of representation of a map, you represent based on scale, you represent based on contents and you representation based on purpose.

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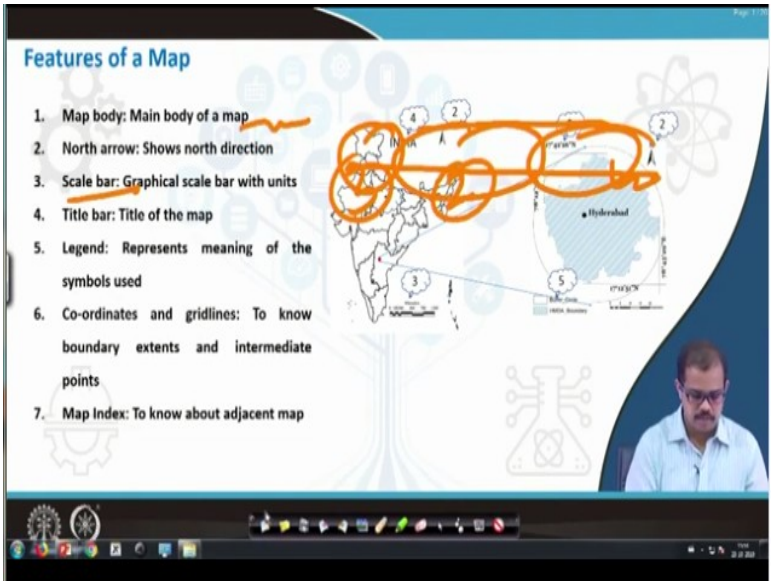

And when we look at the map, so anyone can work on a map, anyone can represent a map but there are certain features that you have to always have in a map. I have seen are a lot of research papers they come out, they would not be the representation of map would be so bad that you cannot really understand or interpret that particular map on as per as the earth surface is concerned.

For example, when you always look at the first thing you have to look at is the map body or it is a main body of the map ok. So if you look at this is the main body of the map ok, if you are representing this, this entire thing is the main body of the map. And you should give the north arrow in that particular map which is representing, which is the northern part of that particular map ok.

For example I have represented here for both Hyderabad and for India, then you need to have a scale bar. This is graphical scale bar with units, for example I have added a scale bar here which is representing every unit is approximately 62.5 kilometers ok. So which means that every unit on the map is approximately 62.5 kilometers ok, this entire scale is measuring from 0 to 1000 units.

And when you look at the title bar the title of the map is essentially very important, it actually describes where this particular map I mean where is the map actually representing on the earth

surface whether it is India whether it is Hyderabad. So for people who do not understand maybe if you put this map in some foreign countries, people may not be able to understand which particular country is this or which particular city is this.

Instead if you give a title for this it would give them a clear picture. Then legend representing the meanings of the symbols used in case you have use certain symbols here. For example I have used a buffer for Hyderabad here, so I have put it as a buffer as a circle, then this particular boundary is nothing but a HMDA boundary ok Hyderabad municipal development authority.

So, this particular boundary also have represented, so that people understand why at this particular shape has been considered for Hyderabad. Then coordinates and gridlines to make the boundary extent, so for example I have put gridlines here and I have represented a coordinate. Why some people may think ok, why I have represented only at 2 places one at the top end corner on the left hand side and the bottom right corner on the right hand side.

So why only this if you understand the way it is represented if you know what this x here, ok, you know the entire x in this particular region it does not change. So if this x is here is the same x here ok, if this is y that is here this entire line it is the same y. So you know what is x and y in this particular point similarly if you look at it is a same here, it is the same y that actually goes in.

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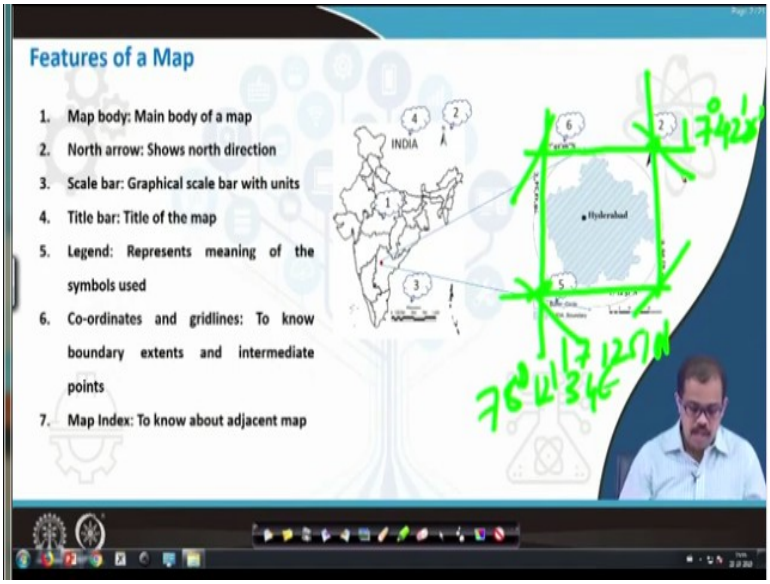

Let me explain it here, for example, if you draw this point continuously like this ok and so it is it remains the same, there is no change right 17 degree 42 minutes 26 correct. It is a flat line and when you draw this it is a intersecting point, so you know what is this point. The same thing is here ok, when you see here it is 17, 12, 51 north ok and when you look at it is 78 degree 12 minutes 34 east, this particular point.

That is how you make out what is the latitude and longitude of the 4 different directions. So, if you know this, the rest can found out or if you know this and if you this the rest can be found out. So relatively you can find out what are the different locations on this particular map ok. So I hope everyone has understood this, then the next thing that you have to understand is the map index which also defines the adjacent map.

Here I have not represented it because it was generated for a particular steady regions I will show you what is the map index when I come to the next set of slides ok.

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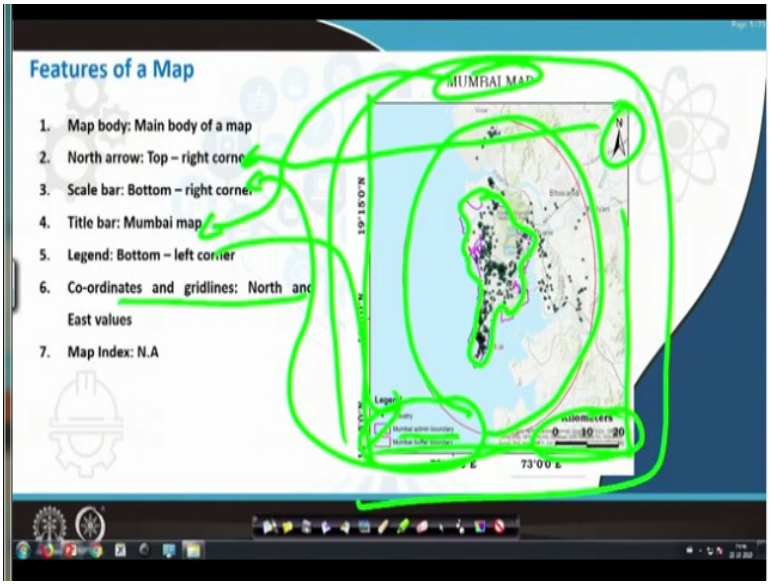

So yeah let me. ok, so just to give you another example of the features of a map. So now this is the main body of the map when you see here this entire thing is the main body of a map I am representing Mumbai ok. So I have given a title, so title is already there, right, so I have given a north arrow, so this is north arrow is represented, I have added a scale here, so the scale bar is represented, ok.

Now I have a legend at a bottom left corner which is defining where are the industries in this particular entire region whereas the Mumbai admin boundary, that is the administration boundary, that is there here. If you see this is the administration boundary and you have a circular boundary that we have used, ok. So it is giving you all the details about what is the map legend right. So that is there and then you have coordinates and gridlines say if you see this is also a gridlines, so all these are gridlines we erase all this things, these are gridlines.

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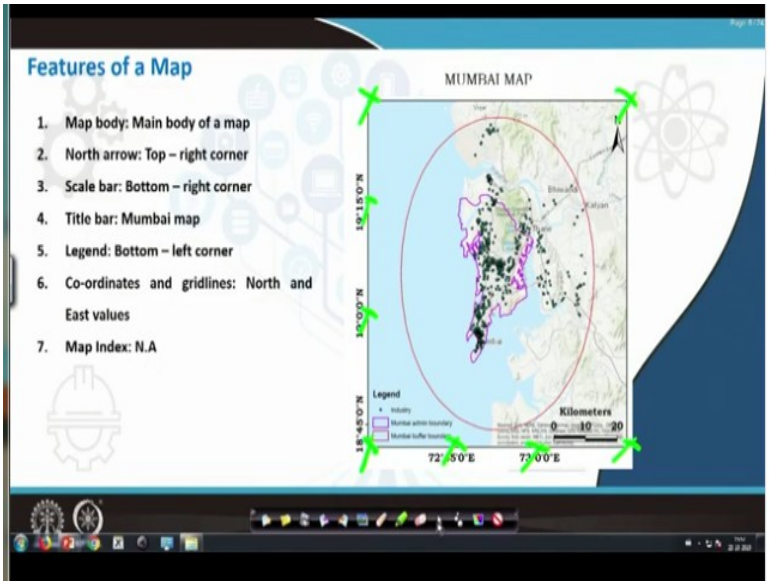

So you know this point, you know this point, you know this point obviously you can know this point. So similarly these points are easily understood, ok, so you know this, you know this fine. So this is what is features of the map, so I am trying to give examples because most of the students make mistakes in terms of where the location of how do you actually put on a map. A map gives you the physical representation, so it has to be extremely accurate in terms of representation, ok.

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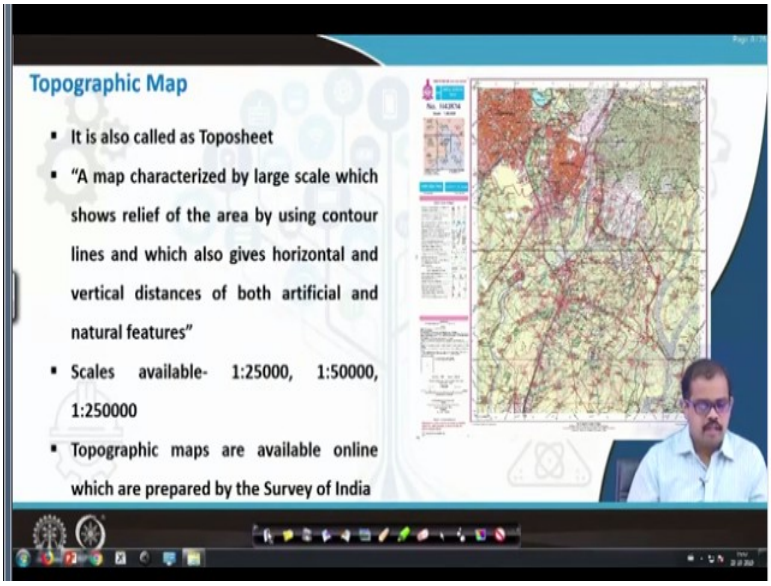

So yeah and when we look at the topographic when I say a topographic map or it is called a toposheet to be more simpler. It is a map that is actually characterized by a large scale which shows the relief of any area by using contours ok and contour lines on which gives you the horizontal and vertical distance of both artificial and natural features that is nothing but your topographic map.

So what are the scales available, we have 1:25000 scale, 1:50,000 scale, 1:250000, I will explain what are the different scales when I start explaining the map. Topographic maps are available online which are prepared by survey of India it is the sole owner and the sole distributor of this maps for India. So, if you want to look at the maps, you can go to survey of India website as I have shown previously give your aadhar number and download the maps as you like for whichever region you would like.

And when you look at this particular map here ok, if you very clearly see this map here and you try to understand this map has its own legend which is actually giving you the types of information that has been use ok.

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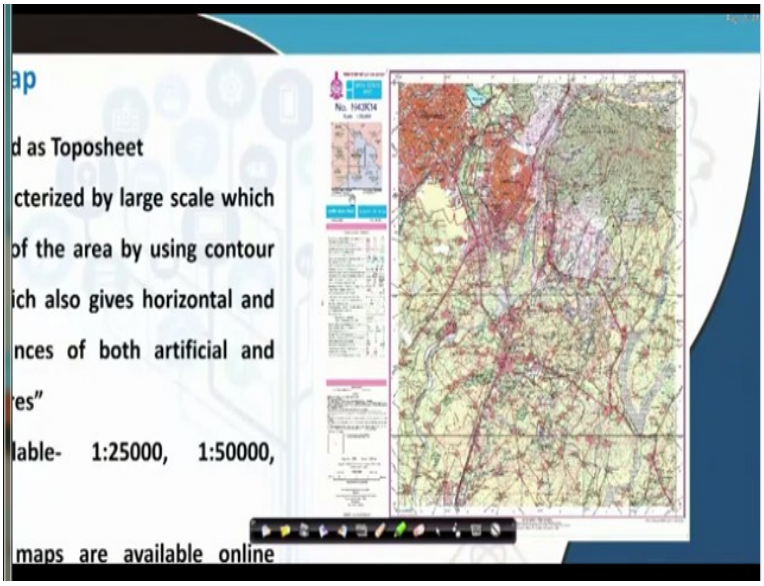

Then it is giving you the scale here it is if you zoom in more you will be able to understand it also gives you the map numbering system which means it says if this is a particular map that I used here. And the next map it represent this part and this map represent this part, so if you access, if you want just a neighboring region, you have to go to this particular map number to see the neighboring region, ok.

And it is 1:50000 scale you can see here a scale is also mentioned, ok, you have the north arrow that is mentioned. And every detail about who has done it what is a kind of a map also has been mentioned in this. So this is the entire complete map that you will have to look at when you are looking at this particular map as a region.

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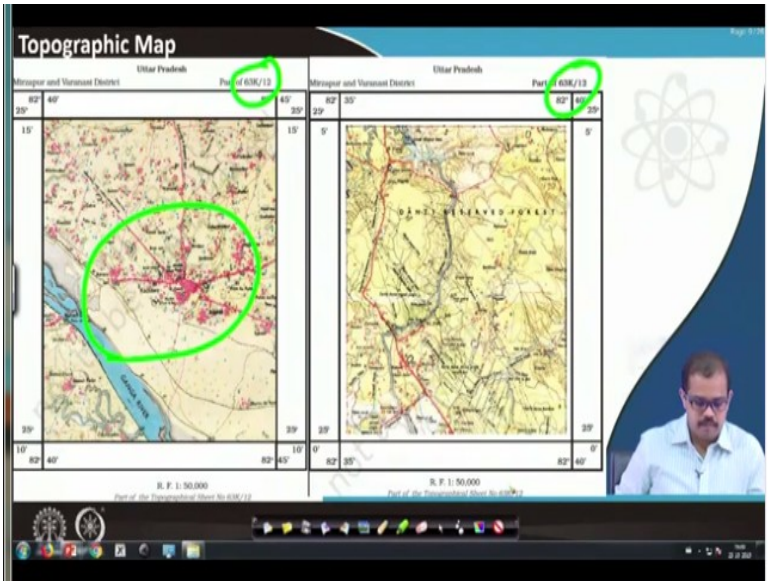

Now just to give you some more examples of different map, this is if you see this, this is a map of Mirzapur and Varanasi district and you can see all details very clearly you can see it as a part number is 63k12 ok. This is the presenting a 1:50000 map, so then you have this representing Mirzapur and Varanasi district, ok. So, this is representing again the 63k12 it is the part sheet number is against 63k12. So you can see this maps topographic maps representing different regions ok, so once you have understood this.

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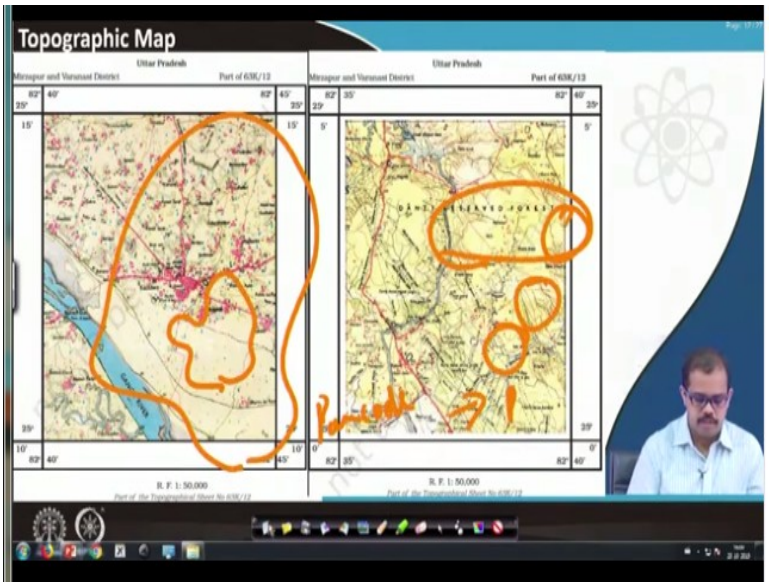

Now lets us slowly graduate to the next set of a representations of a map how Indian India and country representation is used.

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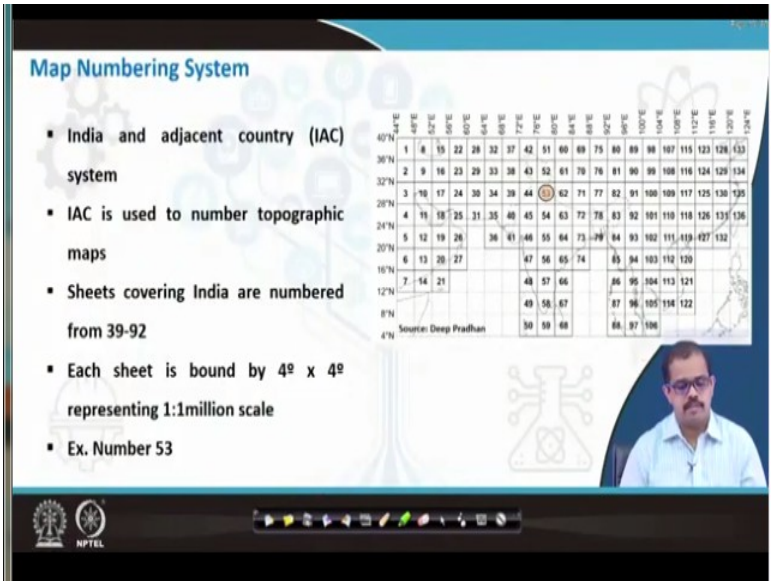

So if you see this particular representation here that is shown on the right side you can see this is how IAC works. So, if you see the map sheet number is 53 is representing this region, IAC you can have details of all of this maps in this particular region. So, IAC used for 2 is used to number the topographic maps, sheet for India which means for the entire Indian subcontinent is from 39 to 92, so that represents the entire Indian subcontinent.

So, each sheet is bounded, if for example now if I have 1 million units on the ground, if I want to see a very coarse map ok. So I have 1 million if I want to just look at the administrator divisions of different probably different states. So if I have to look at it than at 1:1 million map is a very good extent, when I say 1:1 million it is representing 1 unit on the map is equal to 1 million units on the ground that million units, units can be kilometers, meters whatever the way it is represented.

So, in this particular if the map we are trying to see is 1:1 million kilometers on the ground, ok. So now 1:1 million is representing 1 unit on the map is to 1 million units on the ground. So, if you want to represent 1:1 million map it is represented by a number.

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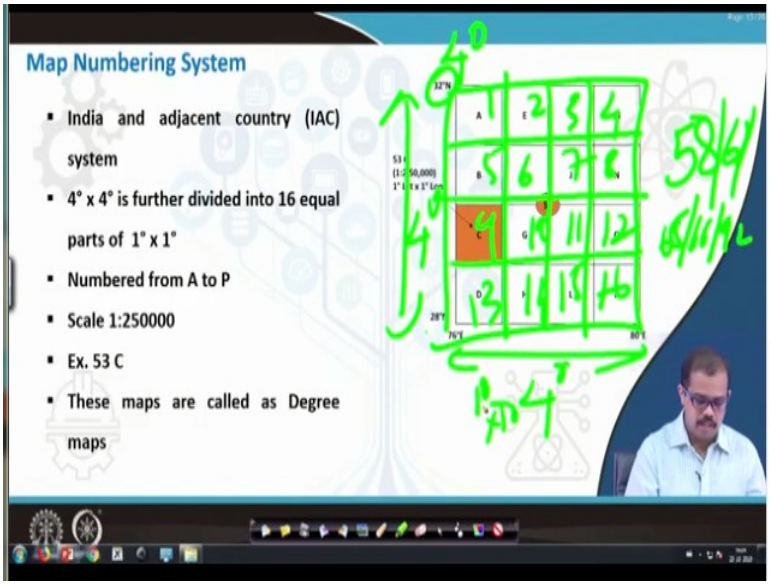

For example the number here 53 **is represented** is representing 1:1 million map of the earth surface that is in Indian context which is here ok. If this is the Indian subcontinent. 1:1 million map of 53 number is representing that region, ok. If you look at this particular map this 1:1 million map is 4 degree by 4 degree map which means to say that this is 4 degree by 4 degree.

If look at it an example given here is 28 to 32 is 4 degree map and this is a 4 degree map, so that is nothing but a 1:1 million map. So that is represented by a number 58 or 61 or 65, 66, 92, whichever state of India or city of India you are looking at. So now, once we have understood this the next division if the same 4 degree by 4 degree map, if this is the entire map that we have taken this is 4 degree by 4 degree map ok.

Now if I divide this 4 degree map into 4 by 4 divisions ok which means the say 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, I have 16 cells. If I divide one 1:1 million map that has 4 degree by 4 degree into 16 cells ok, each cell is 1 degree by 1degree ok.

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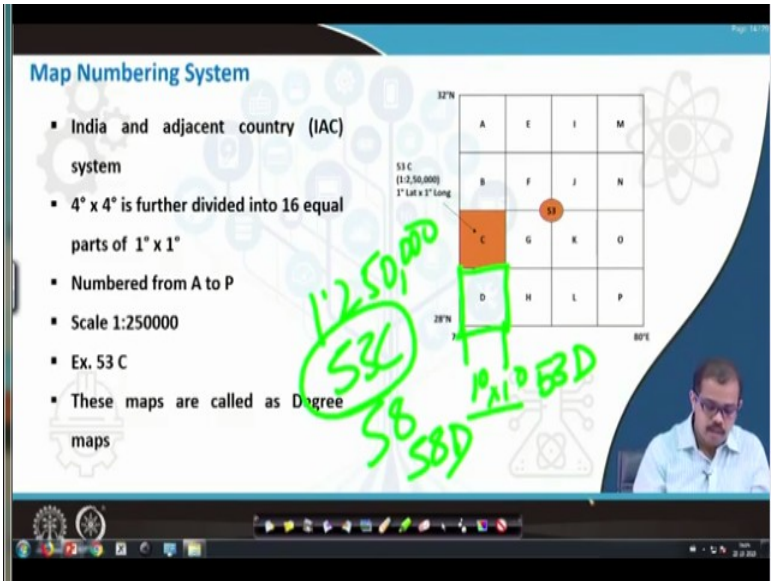

Now let me erase this**,** this cell this 1degree by 1degree and sorry it is one degree by 1degree right. So now this representation if I say 53D, it is representing this particular map in 1:1 million and the scale of this map is 1:250000 scale, ok. Now we have a 4 degree by 4 degree map ok, that is representing 1:1 million scale divide this 4 degree map into 1 degree by 1 degree map.

So you will have 16 boxes, each box is representing 1:250000 map that is 1 unit on the map is representing 250000 units on the ground, ok. This particular representation if anyone writes 53C it is representing 1:250000 map. That is how you can find out the scale if someone is writing **50** 58, it is representing 1:1 million map, if someone is writing 58D, then he or she is representing 1:250000 units map that is the 1:250000 is the scale ok.

And 58D if this is a 58 is the map number 58D is something here, so ABCD, EFGH, IJKL, MNOP ok, so now you have understood 1:1 million 1:250000 map. Once if you have understood this.

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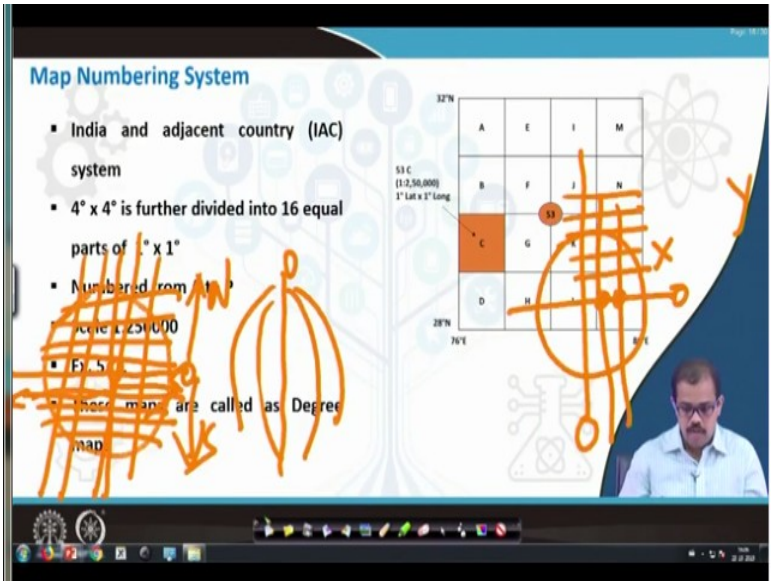

Now let me take this the same 1:250000 map.

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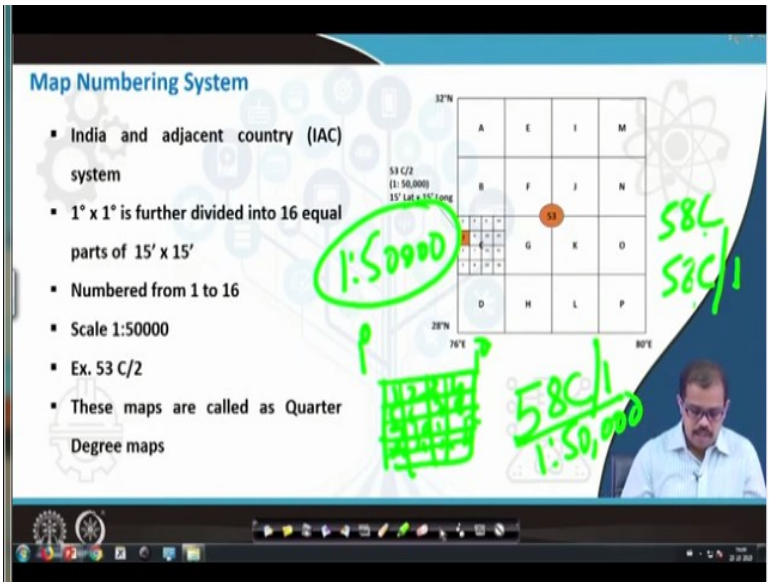

Now once we have seen this now let us say this is a 1degree by 1degree map that is for 1:250000 ok. Now once we have understood this, now let us divide this into 16 equal boxes, something like this. For example the first thing is, this is entire thing is 58, we divided into 16 boxes now we rename those boxes as ABCD right. So, now if I write 58C it is 1:50000. Now, this particular C, I again divide it into 16 boxes and boxes are named 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.

If I put 1 to 16 in those boxes each box is actually representing the small box is actually

representing a 15 minutes by 15 minutes on ground which means it is 1:50000 scale ok. If someone represents 58C/1 ok, this means to say this is a 1:50000 scale map ok. So or it is called as a quarter degree maps. It is extremely useful in terms of when you are using it on a city scale, that is called a quarter degree map.

So, if someone says it is 58 then it is 1:1 million, if someone says it is 58 C. Then it as 1:250000, if someone says if it is 58C 1, then it is a quarter degree map or 1:50000 map. So now one unit on the ground is 50,000 units on the map this 1 can vary from 1 to 16 ok.

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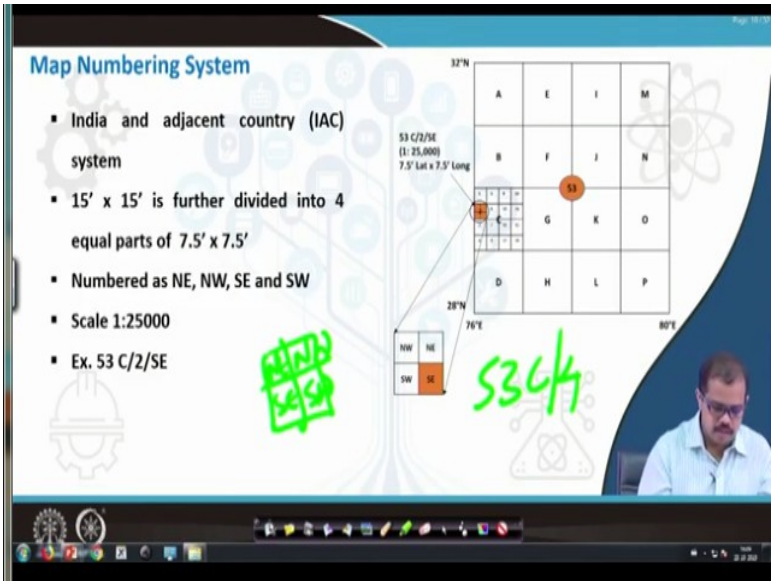

So once we have learnt these 3 scales we will also the last type of representation, the lowest kind of representation that is there in India adjacent countries is 1:25,000 scale. So when I say 1:25000 scale, for example this let say that I have already represented 53C let us say 4 ok. Now, this for fourth box, if I then divide it into 4 boxes were north-east, north-west, south-east, south-west, sorry this is ok.

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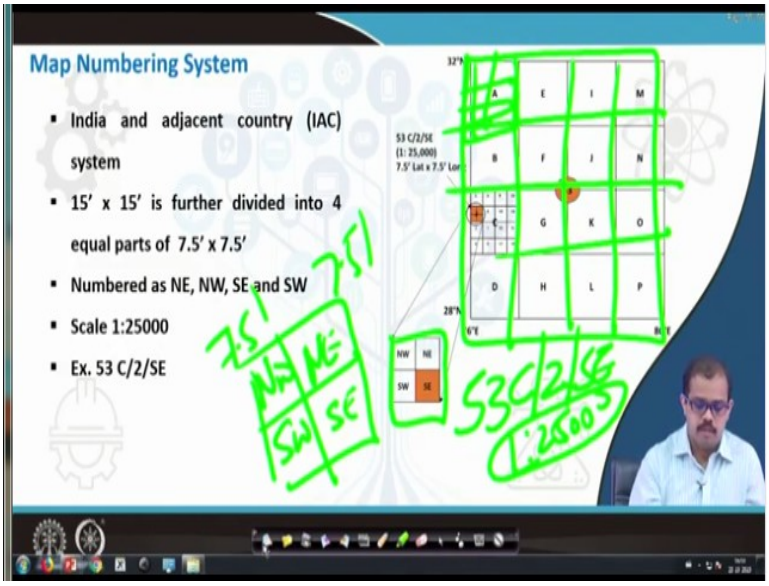

If I take the box this is north-east, south-east, south-west and north-west if I represented like this with this thing is divided as 7.5 minutes by 7.5 minutes ok. This particular referencing is nothing but 1:25000 units, so, if someone writes it is 53C/2/SE, it is representing 1:25000 map which means to say that it is representing the more details on the earth surface. ok, so 1:1 million map is 53, which is represented here.

This is 1:1 million map, then I will divide this into 16 parts, so, it becomes 1:250000 then each box here is again divide into 16 boxes represented by numbers, it becomes 1:50,000. And each number is then the represent is divided into 4 boxes of 7.5 minutes by 7.5 minutes, representing north-east north-west, south-east and south-west, which is representing 1:25000 units on the ground. So we this is how you are map numbering system for India and adjacent countries is done ok. So I hope everyone has understood on how you number a particular map ok.

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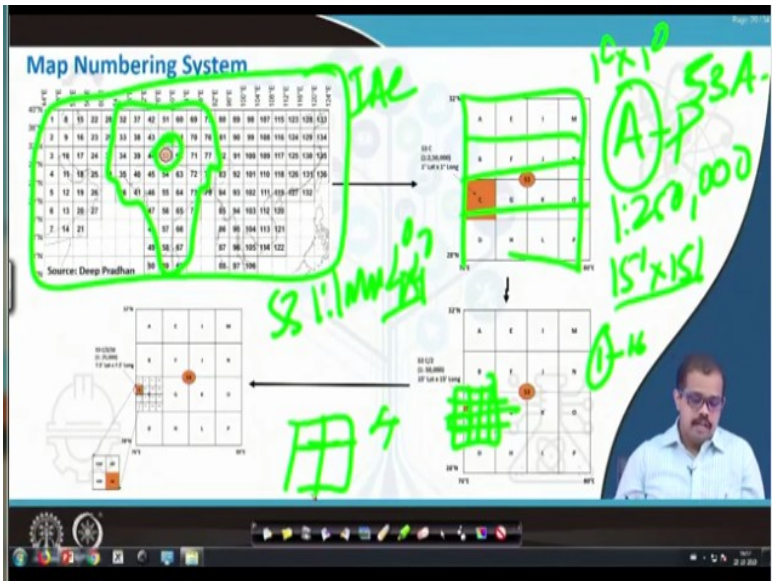

So this is an example of, for the entire process of what I have explained ok, so let me revise this you have this entire system here, this is India and adjacent country system, ok. There are map these are the maps which are actually belonging to Indian subcontinent and if you choose a particular map that is called 53, that is in 1:1 million map ok which is 4 degree by 4 degree map each map will cover the area of 4 degree by 4 degree.

So it is 1:1 million map, 1 unit on the map is equal to 1 million units on the ground. Now this 4 degree by 4degree if you divide that 4 degree by 4 degree into 16 units and name it from A to P. Then each of ABCD is representing 1:250000 units on the ground, ok. So how do we represent this 53 A to through P ok 53A, 52B, 53C, 53D each of them as representing the map ok. Then this for example, if we consider this 53C here ok, then I divide the 53C into 16 different sections and number it from 1 to 16.

Each of this 1 through 16 is representing 1:50,000 map this is a 15 minutes by 15 minutes of size 15 minutes by 15 minutes size map ok. So this is 1 degree by 1 degree map which is I called the degree map this called a quarter map, ok. Now the same, this map the cell any one of the cell from 1 through 16 I will let us consider 4 is then divided into north-east, south-east, north-west and south-west, this is representing 1:25000 map which is **7** 7.5 minutes by 7.5 minutes. So that is nothing but 1:25000 map ok, this is how the representation is done.

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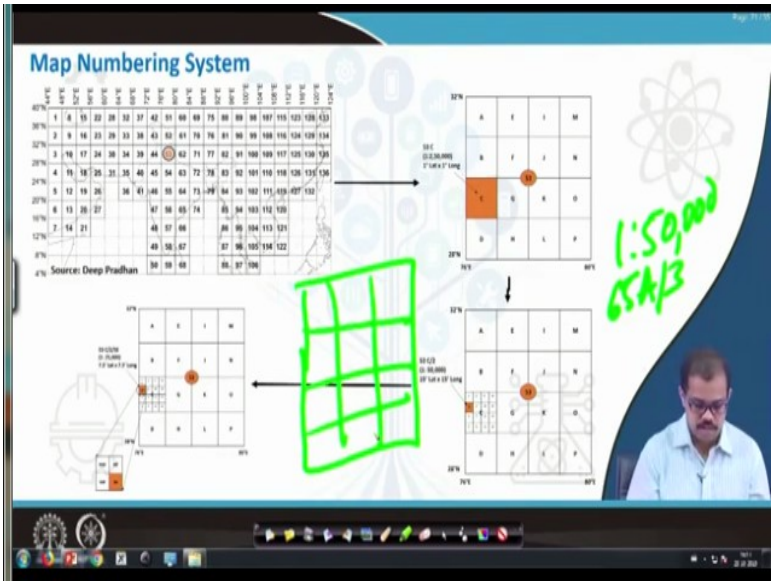

So now, let us say someone is working on a particular city let us take either Hyderabad itself or Hyderabad itself. So Hyderabad is represented by let us say some map number here, ok. Now when a person is trying to work on let us say 1:50000 map. So if we consider the map number to be closer to let us say 65 ok, so when I am writing this 50,000 map it may be 65A/let us 3 ok, this is a map for Hyderabad. So someone has already selected a map which is 1:50000 map, so that particular map a if you look at us ok.

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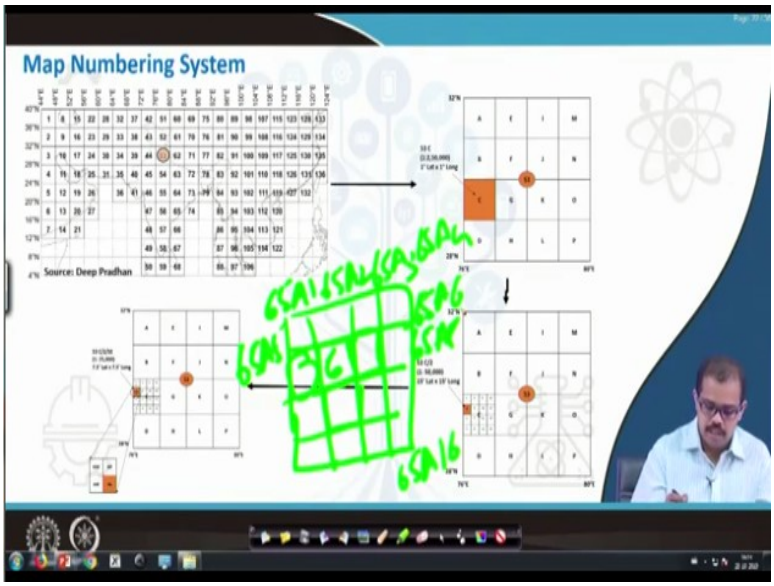

So let me take 16 boxes ok, this is as I said it is 65A1, 65A2, 65A3 and 65A4 until 65A16 ok. Now if someone has taken this particular map, that is representing Hyderabad, this may be, let us say 6. If someone has to find out this map, then he has to just take 65A5, if someone wants this

map it is 65A6, if someone wants this particular map 65A8. This is how you find out which map you may need for adjacent boundary representations ok.

So this is an example that I have taken, so you can look at how the map the retrieval can be done. So I would suggest each one of you to go to survey of India website, download a map also look at map of your region itself ok. Download a map of your region and also look at the neighboring region, download the neighboring map and see you will be able to understand the details in a much better way. And look at the representation, look at how map is actually put in that particular representation ok. So once we have understood this let us move on to the next thing that is the scale of a map ok.

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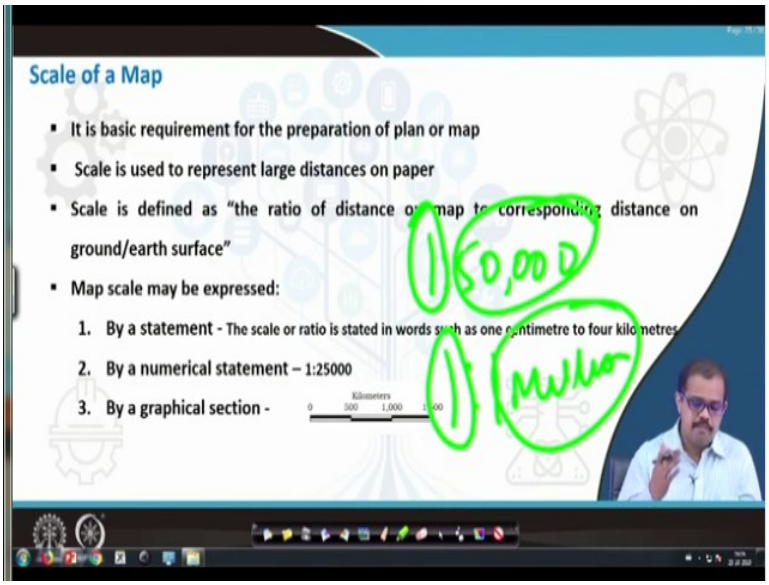

It is a basic requirement for the preparation of plan of a map. So scale is used to represent last distance on the paper, scale is defined as the ratio of distance on a map to corresponding distance on the ground. That I have already said, if I am representing let us say 1:50000 map it mean to say that 1 unit on the map is 50000 units on the ground, ok. If I represent 1:1 million map it means to say that 1 unit on the map is 1 million units on the ground, ok.

So, keep this in mind, so when we look at map scale, it maybe a statement maybe just a statement. The scale or a ratio is stated in words such as centimeters to 4 kilometers, that is 1 centimeter is equivalent to 4 kilometers, 1 centimeter on the map is equal to 4 kilometers on the

ground. It can be a numerical statement, for example, 1:25000, that is what we represented in our previous example. Then it can be in a graphical sections that we have seen in our first slides.

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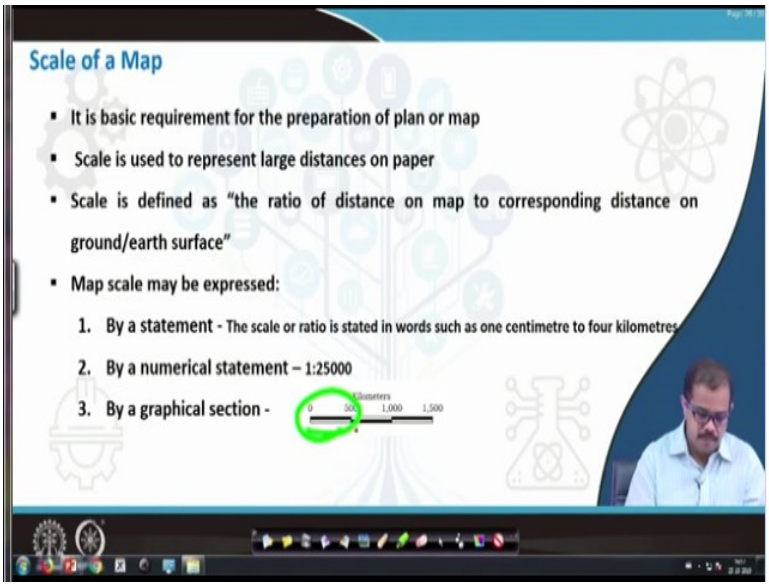

So here when you see this one unit is 500 kilometers on the ground which means 1 unit on the map is equal into 500 kilometers on the ground. So now if we using this unit you can measure what is that particular image-size, ok, what is the area of that particular image length from one end to the other end etc. can be easily found out with just using the scale that is why you need to, you need a scale for a particular map ok.

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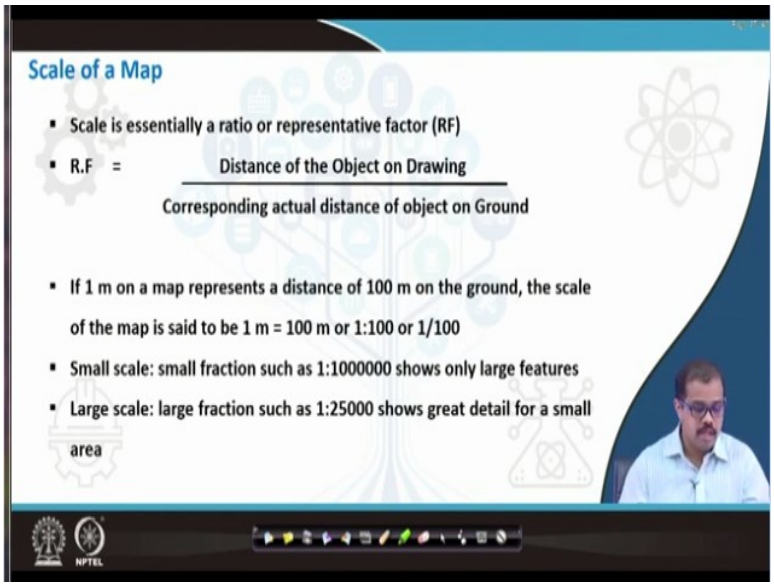

So there are this is about our scale of a map, then scale is essentially a ratio or represented a

factor. As I said it is a distance of the object on the drawing, on the map corresponding actual distance on the ground or often object on the ground. If 1 meter map on the represents a distance of 100 meters on the ground then the map is said to be 1 meter by 100 meter that is 1:100 or 1 by 100 as a ratio of factor ok.

There is one very basic thing that people do not understand is a small scale and a large scale. Small fraction such as 1:1 million shows only large features ok, then it is called a small scale map, large fractions such as 1:25000, 10000, 5000 if there is a map of 1:5000, it shows greater details of information then it is called a large scale map ok.

So, please remember the one that gives you more information it is a large scale, one that gives you the very less information but only the representation is a small scale map, 1:1 million is a small scale map. Whereas 1:10000 or 1:15000 or 1:20000 is a small scale map when compared to a is a large scale map and compared to 1:1 million ok.

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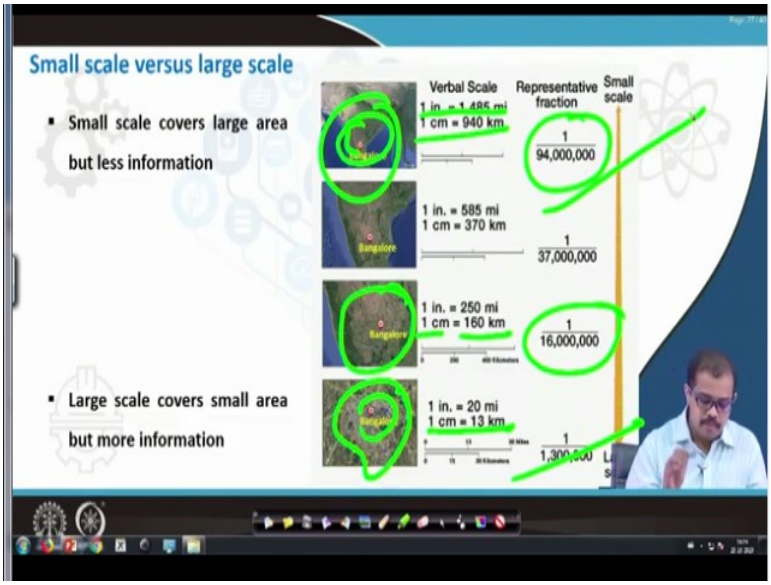

Just to give you an example of a scale, if you look at this the first here is I have represented here 1 inch, 1 inch =.485 miles or 1 centimeter is 940 kilometers. So, the representative fraction if you look at is 1 by 94,000 hundreds is what the representative fraction is there. So, this is giving you the least information, it is only representing Bangalore in the entire country India. Now, I go into more details here, so it is 1 centimeter = 160 kilometer, it is representing much larger the

fractions.

And when you go you are able to see much more details about Bangalore where 1 centimeter is 13 kilometers. This means to say it is giving you a huge wealth of information that is why it is called a large scale whereas it is just giving you the location then it is called a small scale. So, this is a difference between a small scale and a large scale map ok please remember this is where most of the students make a mistake, a large scale and a small scale map ok.

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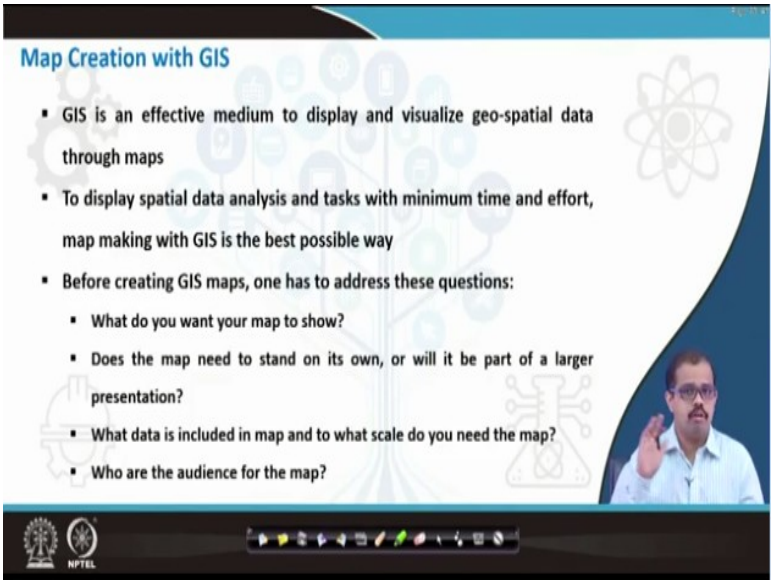

Once we have understood this we the next part is looking at map creation with GIS. So, when I look at GIS is extremely useful in terms of map creation, you can create visually thematically very good images in terms of a maps. So but only thing that you have to all of you have to remember when you are creating GIS map is what do you want your map to show, ok.

Whether it is showing a particular region, particular place, what kind of details you want to show, what are the features you want to show. Then does you a map stand on its own or it is a part of a larger map, so as I have represented an Indian India with then with the Hyderabad. So it is a part of a map or it is only the map that is actually represented, what data is included in the map and what is the scale that you need.

So, the without that you will not be able to really represent a particular map what scale, what is

the representation of a particular map. And most importantly is who is the audience of your map, not every audience will need every kind of map. But what are you actually targeting to, are you representing population and showing it to I mean if you are trying to show population to someone who is interested then you are drawing a population map basically. So, what kind of representation you are trying to look at is extremely important when you are looking at maps.

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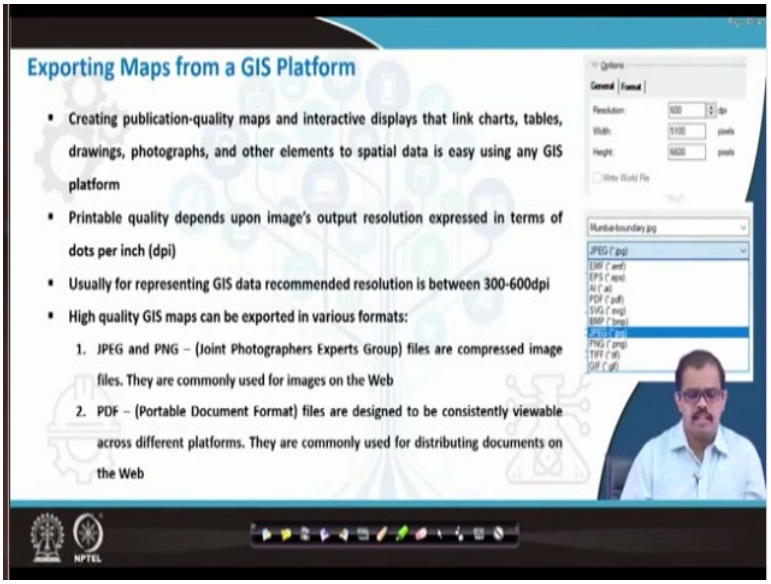

So that is what is very important, then the next thing is how do you export a map in a GIS platform. GIS platform gives you extreme help in terms of exporting a map you can export a map the way you need if I from your using your normal formats like jpeg, which compresses your entire image file to even your svg formats, the raw formats.

Usually it can be exported into any kind of formats, the you can even set the amount of depth of information that you basically need and what kind of format. For example now the matter of being even represented in terms of the pdf the portable document format which gives you a consistent viewable across the platforms, you have jpeg and png where joint photograph experts group and the portable network graphics.

This both of these are used as interchangeable formats in many of the mapping platforms. So, any of these forms, any kind of resolutions that are there in terms of when exporting a map in GIS platform. We look at all of these when we look at the have the look at practicals.

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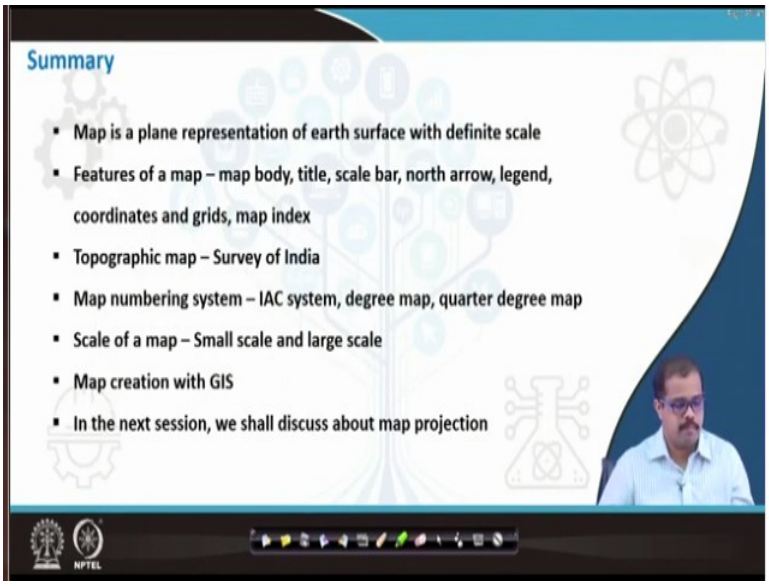

And to summarize map is a plane representation of the earth surface with the definite scale. We have looked at what are the different features of a map, we started with the map body, then we looked at the title. We looked at where the scale has to replace then the northing, then we looked at information about the map certain information that are required, then we looked at adjacent maps also, I gave you an example of it.

Then the map then we looked at the map numbers that has to be represented and the area names are where it is actually located. So that is what is a part of a map, we looked at topographic map and also discussed about the survey of India. Then we looked at map numbering system IAC, so 1:1 million maps is represented by 4 degree by 4 degree and is represented in terms of just a number 53, 58, 60, 65, etc.

And when you go to 1:250000 is a 1 degree by 1 degree map, it is represented by 53 ABCD or just 53A represents **1** 1:250000 map. And if you represent 53A1 which is 15 minutes by 15 minutes map it is representing 1:50000 and if you represent 53A1 northeast then it is representing 1: 25000 map which is representing 7.5 minutes by 7.5 minutes. So that is how the entire India and adjacent systems are placed.

So this is how you do a map numbering then we looked at the scale of a map a large scale map

versus a small scale, please remember this small scale gives you a I mean very less information. Whereas large scale map will give you a very high detailed information. So large scale map is 1:1000, 2000, 10000, 15000 when compared to 1:1 million which is a small scale map, ok. So, please remember this then we looked at how do we create a map in GIS.

But you should look at what is the context in terms of developing a map, so this is what it means by the entire mapping system. And in the next class we will end this particular module by discussing about what do we mean by a projection, ok. So we look at the different projecting systems of projecting a 3D surface into a 2D surface and then look at how we can proceed with that , thank you very much and we will meet in the next class, thank you.