Digital Land Surveying and Mapping (DLS&M)

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Lecture – 29
Basics of Vertical Representation

Welcome students. Today is the 29th class on Digital Land Surveying and Mapping. In this class I will discuss about the Basics for Vertical Presentation. Now, you know the basic objective of surveying is to PPR plan or map.

Now, in civil engineering on any engineering works, the plan or map is required also for to know the nature of terrain on which the engineering project is to be constructed are taken into consideration, but since the map is a two-dimensional way path. So, and the relief or the variations in topography has to be in three-dimensional view. So, there is a problem in depicting the three-dimensional object in a two-dimensional paper. So, there is a specific way how to represent the three-dimensional view of the earth surface on a two-dimensional paper. So, in today's class, I will introduce to that portion of the mapping one.

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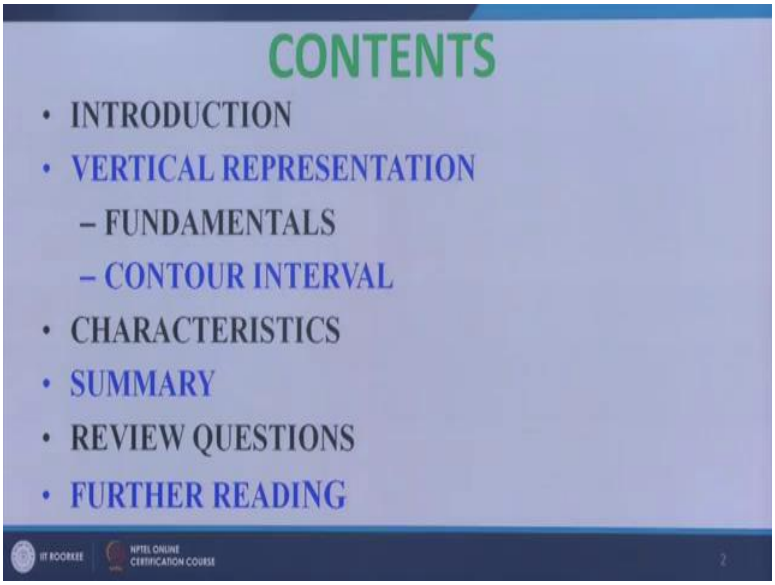

Now, the code today's class will be discussed under this following heads. First I will introduce as I have already told. And then vertically representation fundamentals and there is a specific word called contour interval, which is very important to know and to

be discuss in detail. And some of the characteristics how the representation has to be done we have to discuss. Now, the utility of any plan or map of an area increases as we also depict the relief or the nature of terrain of the topography. Now, to that means, we want we are in need to represent the 3D surface of the earth in a 2D paper. And this is done or can be done in a different ways; there are many methods how it can be done.

However, in case of civil engineering work or engineering map or topographic map, we call it, it is there is a specific way or we do represent the relief of the terrain in a specific way that is what is called contour. That means contours actually are some representation which provides us the elevation and its quantitative value at any point. So, we will not only get the elevation or the nature of the terrain, but also we will get the quantitative value of the height at any particular point at which contour we can have. So, we make use of contours for representation of height or the relief of the terrain. Now, we will discuss about the contour.

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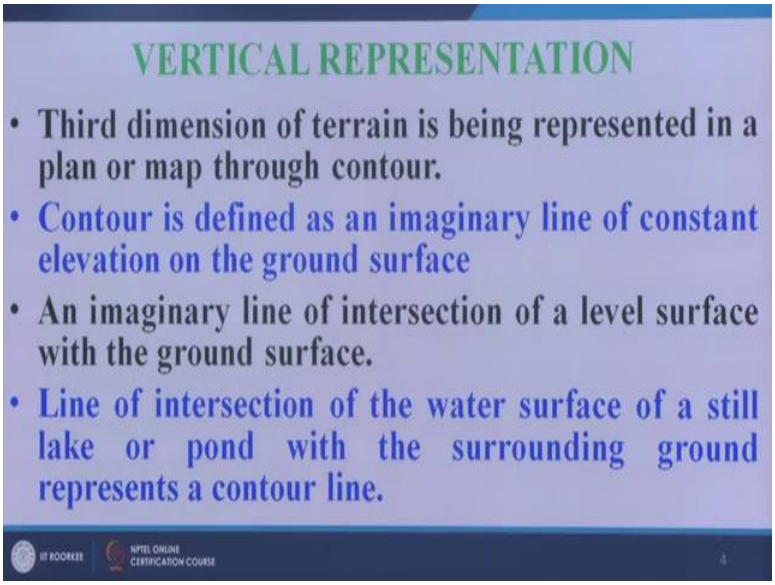

The third dimension of the terrain is being represented in a plan or map through contour. Now, what is contour actually contours are the lines or you can say imaginary line, which represents the line having constant elevatio.

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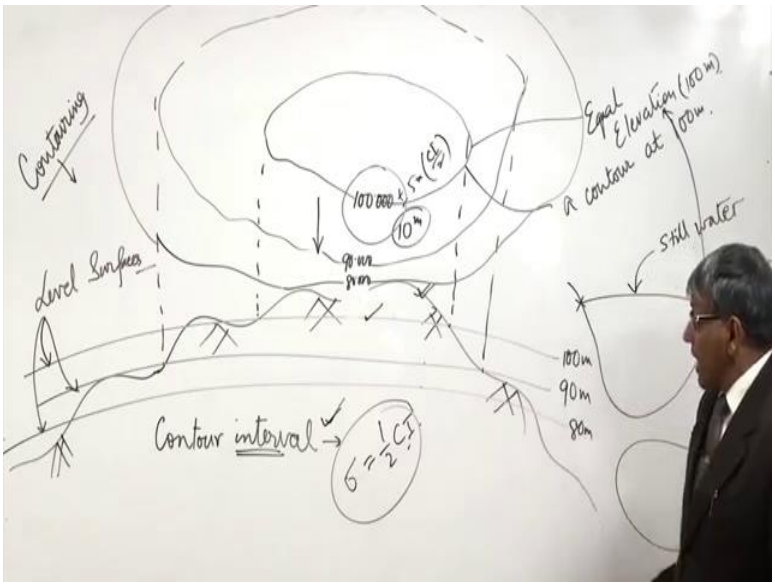

That means if we say this is a contour then we will understand that these points along these line all points on this line, we will have equal elevation. So, other way if we say that a line having equal elevation at each point is called a contour. So, either way we can say that contour is the line of equal elevation or a line joining points or stations having equal elevation we can get a contour. Now, this is what is the definition, but physically we can say like that the it is the intersection of the surface of the earth with a level surface. So, the line of intersection, suppose this is the surface of the earth, this is the surface of the earth, now if we imagine some level surfaces like this, this, this, now these are the level surfaces.

Now, if we imagine from top, if we imagine from top, then we will be able to feel that because this is a three-dimensional object. So, if we imagine from top then there will be corresponding to this point and this point and the area there will be a line a line like this. So, corresponding to this, again we can have a line like this. So, you can see that the intersection of the level surface and the actual surface of the earth will provide us a line and these lines will be of equal elevation

So, now this line will be having, suppose this is a level line at 100 meter, and this is the level line at 90 meter, and this is the level line at 80 meter. So, I can say that the elevation along all through line is 100 meter. So, I can say that this is the line this is the contour, a contour of at or of 100 meter. So, the intersection of a level surface with the

actual surface of the earth provides us a line that line is termed as the contour. Now, this is very well we can see whenever there is a pond, you will see there is the pond, if we see a pond then there will be a water in the pond. And if it is still water, water is not moving still water, then this water surface will be intersecting along the periphery of the pond along the periphery of the pond, we will get a line, and this is also a contour line this is the line having equal elevation.

So, this is the contour line. So, this is the most familiar or widely available contour line that we can easily see if we go to near to any pond or and if the water is in still condition than that water will be meeting its periphery and the line joining the periphery is the contour line.

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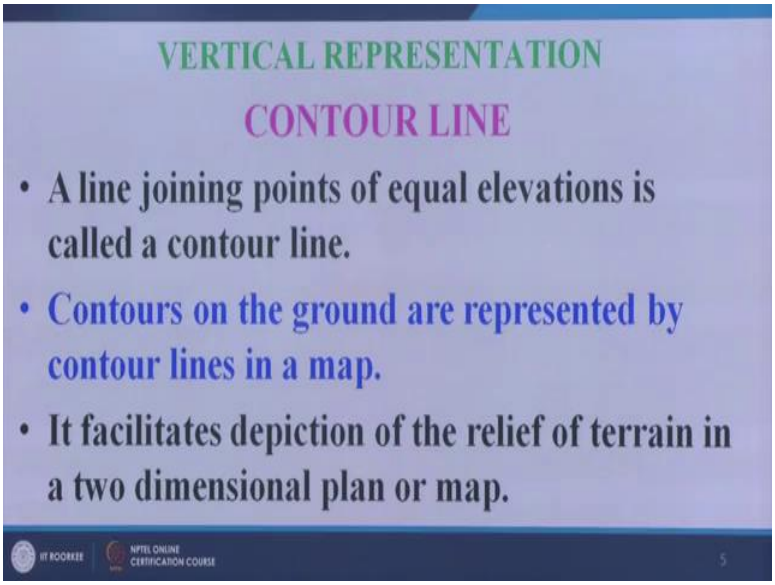

So, this is most of you must have already come across or you can see around. So, contour is a line joining points having equal elevation. And contours on the ground now this is the contour the ground and the line. Now, if I draw this in terms of a map then that is called contouring. So, drawing a contour line in a map is called contouring, contouring is the process of drawing contour lines in a map. So, in case of (Refer Time: 09:57) of plan or map of any area, so we should go for contouring means we have to adopt some methods or we have to do something to absorb the data from the field and download the data and process the data and convert the data to draw lines of equal elevation and that is what is called contouring.

That means, through contouring we will be able to provide the variations in height of the surface of the earth or we can also say that we able to depict the relief of the earth surface along with its quantitative value.

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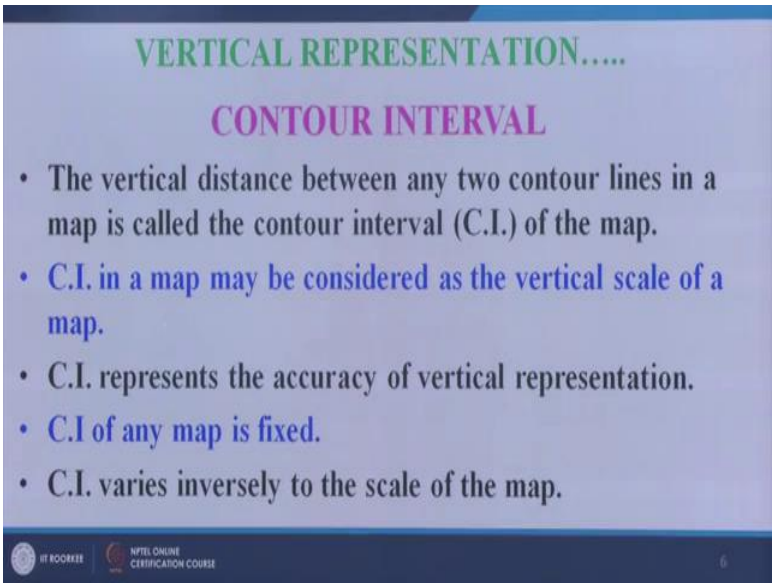

Now, there are different way how these contours has to be depicted how this contouring is to be done. Now, the as we PPR plan or map always we do go for a scale that is called horizontal scale or scale of the map; that means, the scale represent reflection by which we do represent the location of any point that is (Refer Time: 11:17) of any point similar to that there is a concept because we are representing height using contour. So, we need to have a scale for representing in the height or contours, so and that is what it calls contour interval. So, contour interval actually it is the difference in high between two consecutive contour lines.

So, now, in this case if I take the level surface at 80 meter, 90 meter, 100 meter. So, the contours, but we will get in this case will be the you know you know you no one will be our 100 meter then 90 meter then 80 meter, so where you can see that the contour interval is 10 meter. So, contour interval is the amount of difference in contour value between two adjacent contours and that is the representation of vertical scale of a map. Now, this contour interval actually represents the also the accuracy in height that means, it is the half of the contour interval represents the standard deviation in height, which we can permit.

So, I can say that when there is a contour 80 meter, 90 meter, 100 meter then I can say the measurement of height is having an error of plus minus 5 meter which is contouring interval divided by 2. So, contour interval also provides us the accuracy in height measurement or height representation. Another point is that contour interval like our linear scale for (Refer Time: 13:34) positioning, the contour interval also has to be fixed for any map; in any map, we must have a single contour interval. So, contour interval is a very important parameter in case of a map preparation to represent the height. Another point is that contour interval varies to the scale of the map. Now I will be talking on some other factors on which contour interval of a map depends.

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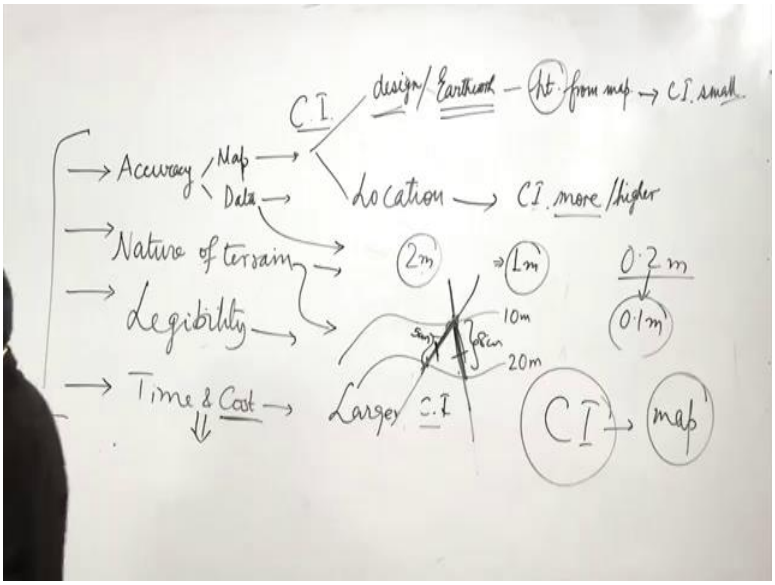

Now, the actually contour interval is a very important parameter for representing the three-dimensional topography on a two-dimensional map. And we have to choose contour interval will very judiciously. And how there are four main considerations under which we do decide about the contour interval of any map. As we have already told contour interval of any particular map is fixed and it represents the vertical scales does the accuracy in representation of vertical height. So, we have to be very much cautious in deciding about the contour interval of any map, and contour interval of any map is based on four primary criteria, apart from many other criteria.

First one is that accuracy: now accuracy from two considerations accuracy from the consideration of map preparation; and accuracy from the consideration of data

availability. Now, let us consider on the map consideration means the accuracy of the map will depend upon the purpose for which we will be using the map. Now, there are two types of fundamental use of height of the map one is for design purpose and another is for location purpose. Now, when the map the height from map will be used height from map will be used for design purpose also earthwork purpose. We need to have a very accurate means quite accurate height value.

And for that we need to have our contour interval very small as small as possible so that means, we should have the contour interval very close to each other contour should be having very close to each other, so that the error in height will be less. And that will lead to less error in design parameter as well as computation of earthwork.

And on other hand, if we make use of the map in for location purpose, we do not need much accuracy in height. So, we may afford to go for more contour interval means or higher contour interval. Now, e also the data, now as we know that contour interval represents the accuracy in height. So, with what accuracy we will be measuring the height or what is the accuracy of measurement of height depending upon the accuracy of measurement of height we have to take the contour interval that means, if the accuracy is measurement of in height is suppose 1 meter, accuracy measurement of height in 1 meter.

So, we cannot go that means, our standard deviation can be 1 meter. So, we can go up to 2 meter contour interval, we cannot go less than that because half of this is the error accuracy. So, after getting all or if you say that we want to have a contour interval of 0.2 meter. So, we must go for measurement of having the accuracy of 0.1 meter. So, in that way we can guide our survey work or from the measurement already done, we can also decide what should be contour point.

Now, for the next category is that nature of the terrain nature of terrain. Now, in case of now nature of the terrain generally will do take the contour interval higher as the slope is move. So, that the number of contours that is available in the map is fairly distributed, and the other objects of features can be seen quite clearly. And then the third one is that legibility. So, as I told you that the number of contours in the map should be such that it does not cover the other objects present, all of the presentation. So, as I told you nature of ground that the number of contours should be inversely proportional to the slope

higher the slope, larger the contour interval. So, because if the contour interval is more than we will get less number of contours for the difference in height.

Further, another important point is that time available and cost. So, if the time available is less than we have to go for larger contour interval, because that will lead to less amount of data and less amount of survey work, and also the cost will be less. So, with the time and cost less, then you should go for larger contour interval; otherwise if we want to have the contour interval small, then the involved time involved and cost involved will be more. So, these are the criteria which we do take and while will be deciding about the amount of contour interval for a new map and which is nothing but the vertical scale of the map.

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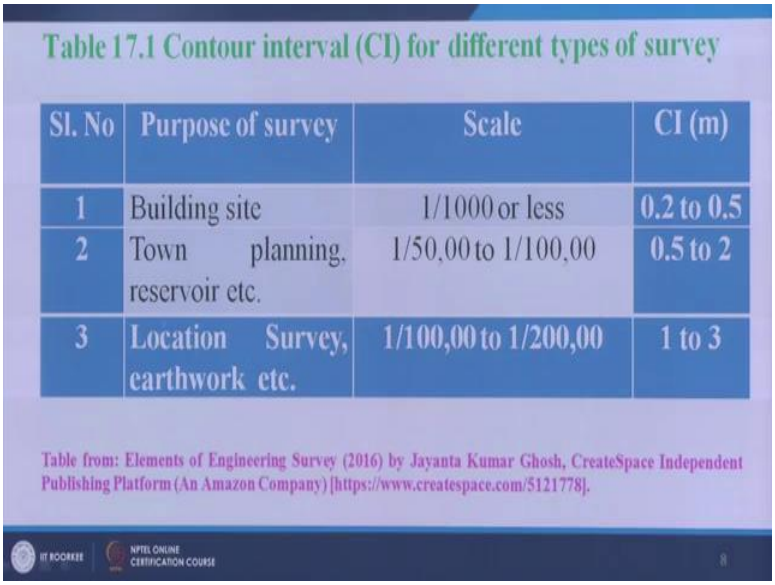

Now, the here some of the representative value for the contour interval that if we want to go for construction of building that site and the scale of map is 1 is to 1000 or less that means, larger scale then our contour interval we should take from 0.2 to 0.5. Now, if the if we go for town planning or reservoir construction band, we will like to have our map in the scale of 1 is to 50,000 or 1 is to 100,000 or 1 is to 10,000 or then contour interval should be 0.5 to 2. When we go for location survey and if the scale is 1 is to 10,000 or 1 is to 20,000 then our contour interval can be 1 to 3, so depending upon the purpose also our scale values, also contour interval. So, actually contour interval is the vertical scale

and this is the linear scale telemetric scale. So, we can see that if the telemetric scales are larger than our contour interval should be less.

Similarly, another way how we can classify about the vertical scale or the contour interval is that what is the mapping scale means our telemetric scale is large for different types of terrain contour interval will also vary.

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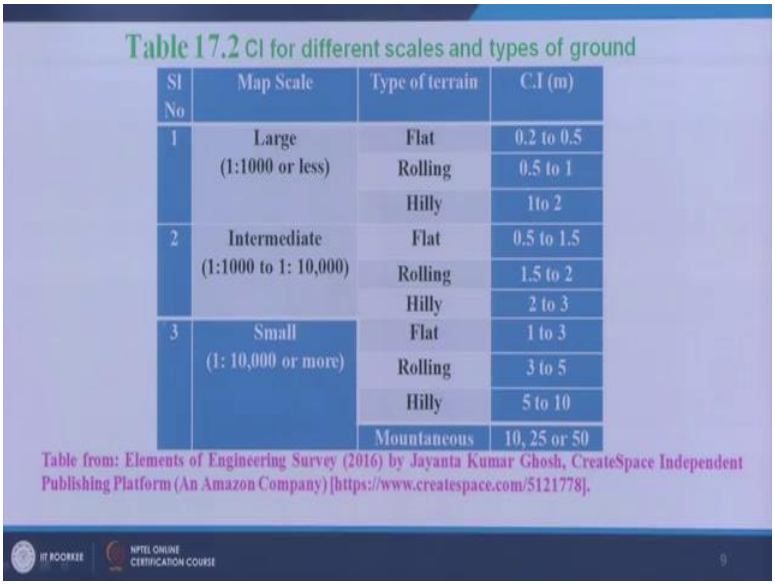

Now, you see for some same scale if the terrain is having higher slope then we will have contour interval larger as I have already told that hilly terrain will becoming more slope, that rolling terrain will be more slope then the flat terrain. So, the contour interval is directly proportional to the slope; however, the slope contour interval should be more that will help us to minimizing number of contours in the same amount of mapping area, so that means, our contour interval grounds from point two to too depending upon the type of terrain for a larger scale.

And it varies from 0.5 to 3 meter. In case of intermediatory scale and for a small scale it may vary from 1 meter to 10 meter. In case of small scale and for mountaneous terrain, the contour interval maybe 10 meter, 25 meter or 50 meter. So, this is very important to decide about the contour interval, one will be preparing the map because this provides us the accuracy of height measurements.

Now, next point is that after deciding the contour interval, we have to go for contouring; that means we have to draw the contours. Now, to draw the contours we need to follow some characteristics of contours, and we need to know some point which will help us to draw the contours properly and so that the contours represent the nature of terrain properly.

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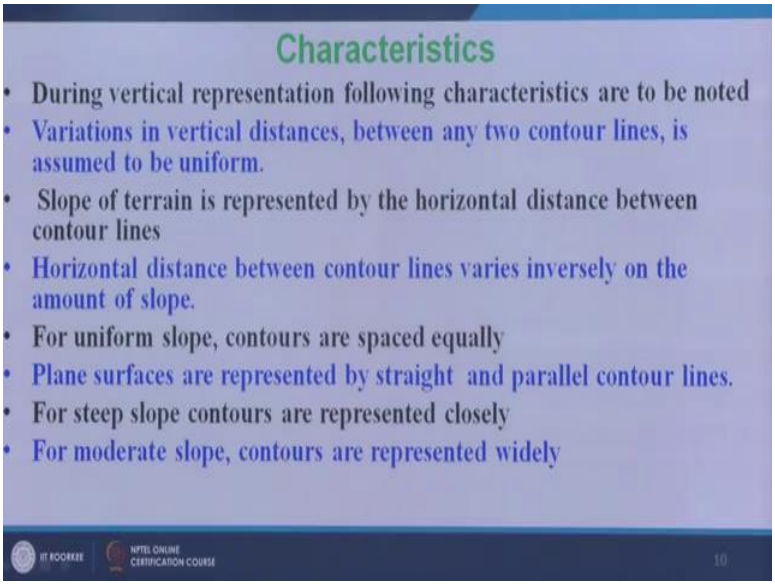

Of this, we need to know first that the variation in vertical height between any two contour line is assumed uniform. So, if I say this is the contoured this is another contoured now between these suppose this is the contoured of 10 meter and this is the contoured of 20 meter that means, the height is increasing. So, if we take a line along this then we will assume that the slope of this is constant. So, this is a very important thing, we have to minimum. And the slope is represented by the distance.

Now, you see if you say along this line, the slope is constant; along this line is also slope is constant, but the amount of slope for this point to this point, and the amount of slope point this point to this point along this line will be different depending upon the distance. If this distance is suppose 5 centimeter, and if the same distances 8 centimeter, now you can see that for 8 centimeter distance, the difference in elevation is 10 meter, all in this case for a distance of 5 centimeter in the map the vertical distance is 10 meter. So, this slope along this line will be more than these, this is what will be slope can have that. Horizontal distance between two consecutive contour where is inversely among the

slope; if the horizontal distance is less than the slope is more; if the horizontal distance is high, then slope is less.

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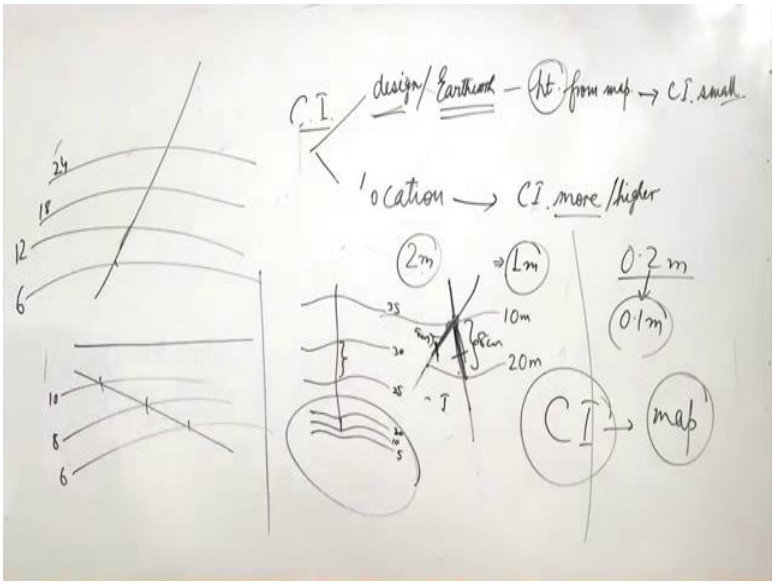

Now, how we do represent the different types of terrain. Now, if the terrain is flat, flat like this. So, in this case, our contours will be very highly spaced. Now, if the terrain is uniform slope, now you can see suppose our contour will be spaced like this, if I say these level lines they will be equally spaced. So, our contour line will be equally spaced. Now, if the steep slope, so if these slopes are very steep, so as you can see that the level lines suppose this is 10 meter, this is 8 meter, this is 6 meter. But in this case the same distance will be your 6 meter this will be 12 meter, this will be 80 meter this is 24 meter because slope is very high.

So, for the same distance it will be more height. So, steep slope we will have the contours now if we see this thing like this and like this now we can say that suppose this is your 5, 10, 20, 25, 30, 35 meter, 5, 10, 20 meter. So, this is the area where slope is very steep because for the same horizontal distance or difference is height is more, whereas this is a less slope because you the horizontal distance will be more having the same change height. So, in steep slope, we will represent through very closely contours; and for flat terrains or less slope the contours wide spread widely.

Now, the steeper slope of terrain is representing along the normal. Now, if this is the contour what will be at any point what will we be the steeper slope. So, if we draw a

normal to that that mean joint tangent to this and not that means, this is the direction where we will get the steepest slope. So, steepest slope we must have the steepest minimum radius of curvature of the contour.

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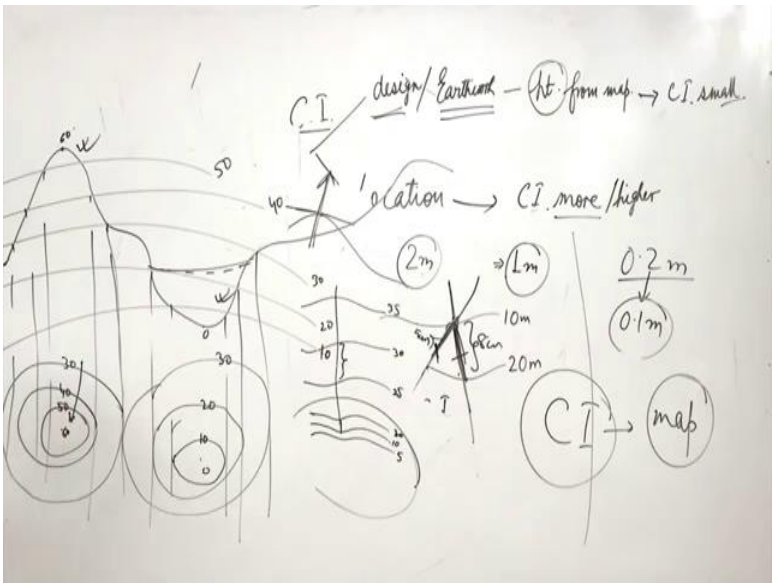

Now, if there is some depression are use in a terrain, how we suppose I have like this. Suppose this is the water and then this is the hill. So, the for the hill terrain, so what we do you do take level surface like this. Now, you can see if I say this is our 10 meter, 20 meter, 30 meter, 40 meter, 50 meter level surface, so corresponding to that we can draw these figure and this is suppose 60 meter. So, if we draw like this, so we can get the 60, 50, 40, 30. Also in this case also we can say this one, so where is also like this there it is suppose 0 meter. So, now, both in the whether it is a hilly terrain or whether it is a depression in both cases we get a concentric rings of contours, 0, 10, 20, 30, but in this case the value of the contour is increasing towards the center, in this case value of the contours decreasing towards the center.

So, both hills as well as the depression we represented through concentric contour lines, but in one case it is the increasing invert in case of hilling and in case of ponds the value will be decreasing towards the center. So, in that way, you we can we do the represent different physical for surface of the earth in a different types of contours.

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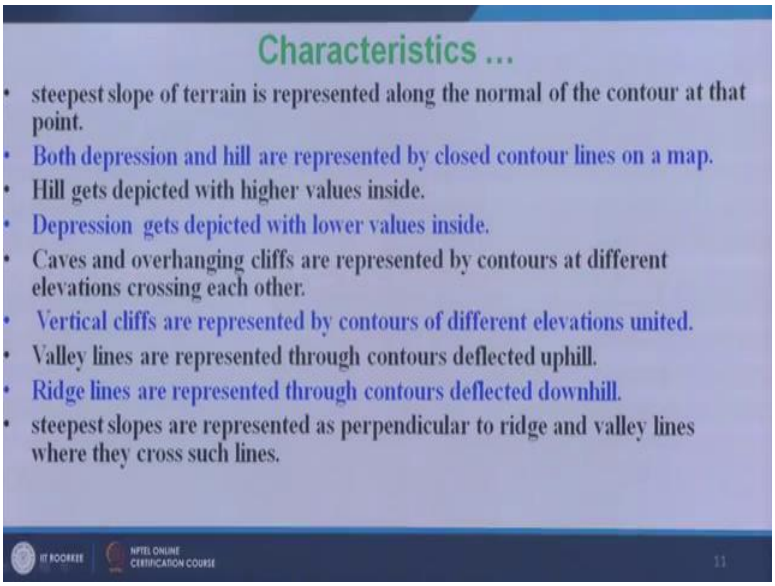

Now if there is a cave or overhanging cliffs, we will have contours at different elevations. But there will be some crossing each other now if there are a vertical cliff the contours are define elevations united suppose this is a vertical cliff like this.

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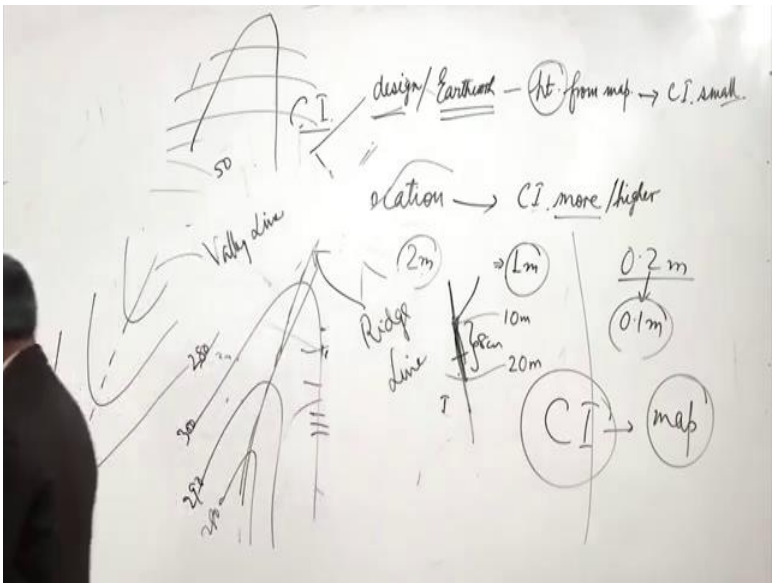

So, like this if we here you can see this will be if we draw the contour then we will get like this. So, in this here there will be contours will be joining. And from there we will be able to understand that this is the vertical cliff. Now, contours a valley lines and ridge lines. So, in case of hilly terrain, we will get valley line. So, the valley lines will be

represented by this inverted cross uphill. So, I can say this will be valley line. So, this is our 300, 290, 280 meter. Now, for which we will get the inverted u shaped line and this is the line of ridge line and this is our 300, 290 and 280 like this. So, this is our ridge line and this is or valley line. So, valley line can be represent by using inverted this contour line pointing towards uphill and inverted u line also pointing downhill.

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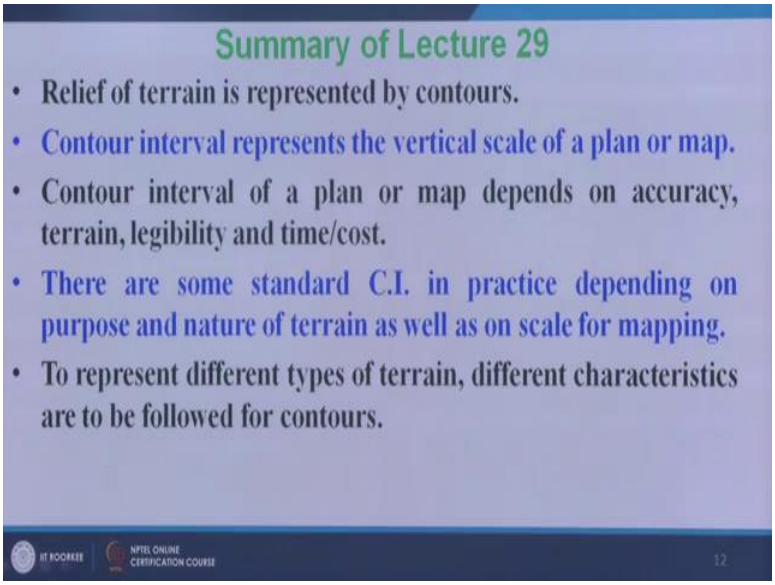

So, in that way different types of physically feature can be represented using contours. With this I like to conclude today's class. I like to summarize this that the relief of terrain is represented by contours. And contour interval represents the vertical scale of the plan or map. Also contour interval provides us the accuracy in measurement of height. And the contour interval has to be decided depending upon the accuracy terrain condition, legibility of the map and time and cost available. There are some standard contour intervals available in practice depending on the purpose and nature of terrain as well as scalar mapping. To represent different types of terrain, a different characteristic of the contours has to be kept in mind and during this depiction.

With this I like to conclude today's class. Next class, I will be talking on contouring.