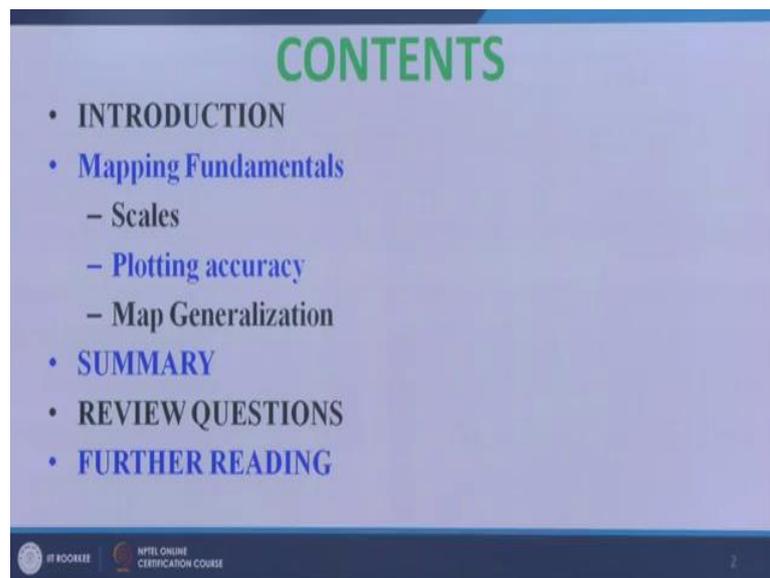


Digital Land Surveying
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Lecture – 31
Mapping Fundamentals

Good morning students, today is the 31st class on digital land surveying and mapping, in this class, I will be talking on fundamentals of mapping. Now you know that the objective of surveying is to prepare the plan or map of the area and I will be discussing before making the plan or map of the area. In fact, before doing the surveying we need to know some of the fundamentals or we need to consider some of the primary considerations that has to be taken up in mapping the area. So, this is what we will be discussed today.

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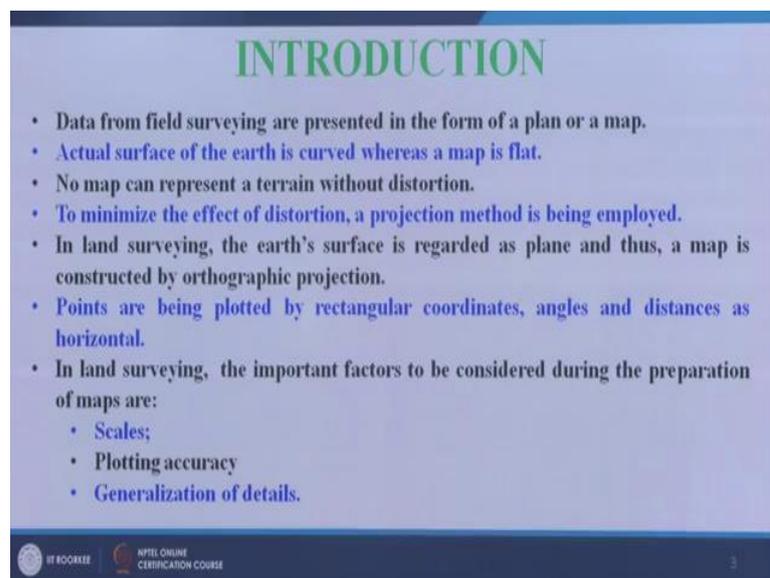
And the topic will be discussed under following heads that first I will like to know why really we need to know the fundamentals and then the define consideration for these fundamentals and the need for that.

Now, we know that the surface of the earth is cut or as the surface of the map or the plane in the paper on which we do represent our surface of the earth is a plane area. So, in energetic term we can say that the 3 D earth surface object will be you need to be represented in a 2 D map surface now not only that that a whole surface of the earth is a

bound with method information now many of information may be useful for our purpose and may be may not and also sometimes some of the information though it is useful, but there is a some other problem while we are going for preparing the map and we maybe need to know which information has to be maintained and which has to be taken out. So, there are. So, many issues that will come now above and above that there are. So, many other considerations which we need to do about mapping before we start our surveying.

So, the fundamentals during the mapping has to be understood before we carry out the surveying and also we should know what are the requirements of the mapping or what are the use of the map or the outcome of the surveying has to be also ascertain before we start the surveying work.

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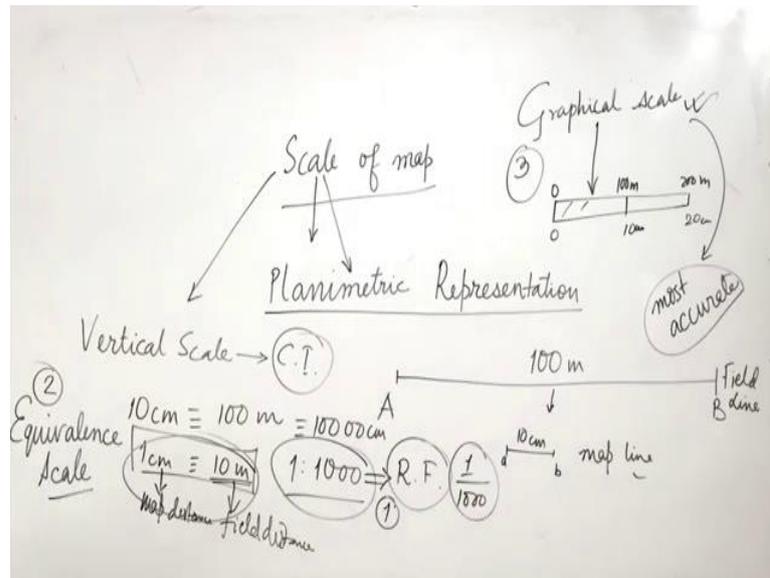
INTRODUCTION

- Data from field surveying are presented in the form of a plan or a map.
- Actual surface of the earth is curved whereas a map is flat.
- No map can represent a terrain without distortion.
- To minimize the effect of distortion, a projection method is being employed.
- In land surveying, the earth's surface is regarded as plane and thus, a map is constructed by orthographic projection.
- Points are being plotted by rectangular coordinates, angles and distances as horizontal.
- In land surveying, the important factors to be considered during the preparation of maps are:
 - Scales;
 - Plotting accuracy
 - Generalization of details.

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But if you summarize whole of the things we can combine to 3 aspects like the scale plating accuracy and generational detail these are the 3 main aspects really we should understand with reference to map making and in particular to particular surveying work which we will be conducting for preparing the map and now the map scale a scale now already we have discussed that there are scaled of map scale by scale of map.

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Generally we understand that the scale is the for planimetric scale for planimetrics positioning or parametric representation and as you know that our topographic map will be considering the representation of 3 D are subject in a 2D object and also in last classes I have discussed about the representation of third dimension and the vertical height through contours and another thing which related to vertical scale is that contour vertical. So, now, at percent in this class I will be restricting my discussion on the scale related to planimetric representation.

Now, what is the scale? Now by scale what we mean suppose there is a line A and B which is 100 meter length in the field and this 9 is represented by a line A B of length 10 centimeter in map this is the field, this is the field line and this is the map line now; that means, 10 centimeter of the map we represent a length of 100 meter in the field. So, we call that 1 centimeter equivalent to 100 meter. So, this is the scale of the map sometimes also represent buy some other way like 100 meter means we can say this is the 10,000 centimeter. So, that 1 is to 1000, this is another way how we do represent. So, this is called representative fraction.

So, representative fraction; that means, 1 upon 1000, so this is the representative fraction by which we do represent a scale of a that is the a planimetric scale and sometimes we do represent it by a unit like this; this is called equivalency scale equivalency scale in

equivalency scale we do represent the small distance which is far distance this is the map distance and the equivalent distance in the field distance this is field distance.

Apart from this there is another way how we can provide the scale in the map that is called graphical method or graphical scale graphical scale now what is the graphical scale in the map in the region box we will draw a line of length suppose 20 centimeter I have drawn 0 10 20 actual length is 20 centimeter, but I will write it 0 100 meters 200 meter. So, actual length is 10 centimeter and 20 centimeter, but as my scale is one centimeters to 100 meter. So, 10 centimeter will be 100 meter.

So, this is the graphical scale a graphical representation of the scale. So, in these 3 ways how we can number 1 is that representative fraction scale or equivalence time or graphical time there are 3 ways how we can represent the volumetric scale in a map now of these 3 actually the graphically scale is the most accurate most accurate the reason behind is that one thing is that we can draw the distance more accurately and we can see and we can give it to the map, another plan which is important with the graphical scale is that or if you take any copy of the map the amount of expand enlargement or reduction of the map will be same as the enlargement or reduction in size of this graphical scale.

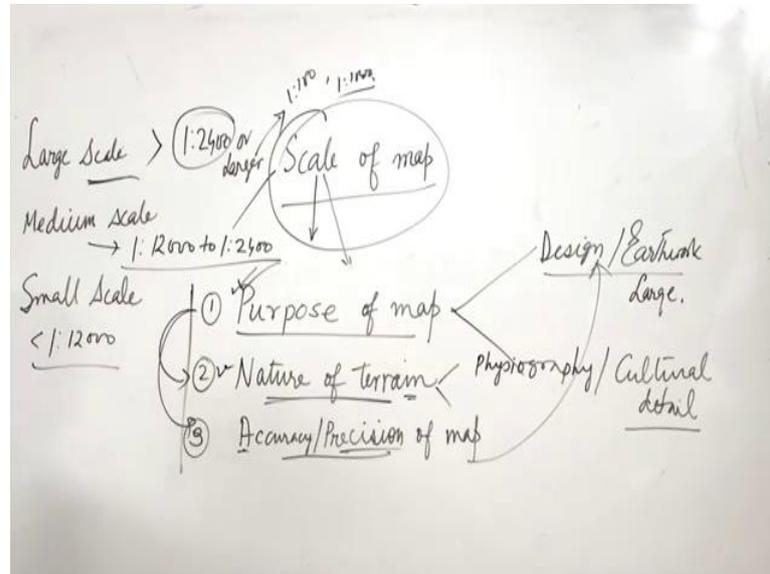
So, all these will give us the measurement in distance of the map using graphically scale more accurate than other scales. So, generally we prefer the graphically scale, but; however, in most cases also find that (Refer Time: 09:43) deflection is also mentioned in the map.

Now, this scale, scale of map now this is a very important issue with respect to the map because this is way how we are representing the actual surface of the earth on a defined map surface. So, now, it is not that simple to be there are many factors on which the scale of map has to be chosen actually we have to choose what is the scale of the map or scale at which we will represent the surface of the earth and the depending upon the scale of the map actually scale also represent the accuracy of presentation as well as it will represent by (Refer Time: 10:33) of the measurement.

So, whole (Refer Time: 10:36) of our surveying planning all these things what is the method of measurement what will be the instrument in measure what will be the accuracy of measurement what is the quality of measurement all these we will follow the

scale of map. So, scale of map we should understand very clearly and its significance has to be understood nicely before we carry out any surveying work.

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Now, the factors which really guide the scale of map the most important thing is the purpose that will what is the purpose for which we are going to use the map this is the most important thing which will guide about the selection of the map and apart from that another and other important is nature of the terrain and nature of terrain and then also what is the accuracy or precision accuracy or precision of the map we are looking for of map.

So, these are the 3 important factors which is which does the selection of the map of course, there are. So, many other small criteria which has to be considered beyond this to select our scalar map like part of the resources available and many other things like that now purpose of the map now we may make use of map for design or earthwork for design and earthwork design work or earthwork we need more accurate; accurate or precision map. So, whenever we will like to have our map to be used for design purpose or may earthwork purpose we need to have more precise and accurate map and in those cases our scale should be large, purpose is like our planning purpose also or some location purpose then we may go for our map in a (Refer Time: 12:52) small (Refer Time: 12:53) scale.

Nature of terrain as we can see that if the terrain is very smooth plane then we may go for quite large scale because the grades will not be much (Refer Time: 13:09) if the much terrain is very stiff or unrelenting then we should go for large scale that. So, that we can go for more precise presentation of the heights and all those things.

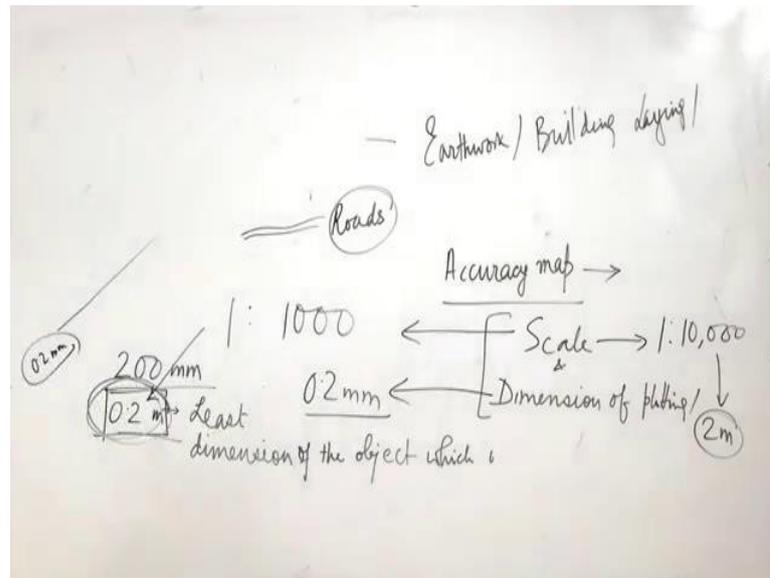
Again not only the physiography also what is the physiography as well as cultural detail physiography as cultural detail if the cultural details are more then we will not be able to go for very very or very precise presentation of so many things. So, then we have to go for very large scale, but we what we find that these factors are mutually continuity; that means, before want to start the purpose of the map properly there may be we will be doing inductive to the criteria that nature of terrain really enhance.

So, anyway, now, all sometimes we may be able to take care of the accuracy by which really we are looking for, if we want to do justices to the nature of terrain even if there are contributory. So, there lies the utility of the angina in charge to select the consideration of the scale of map.

Now, the scale of map is basically we do define into 3 classes that is called large scale then medium scale and then our small scale. Now large scale actually there is no hard and fast rule for that, but generally (Refer Time: 14:52) this scale is 1 is to 2400 or larger; larger means your (Refer Time: 15:00) representation is like 1 is to 100 or 1 is to 1000. So, these are larger scale then 2000; 1 is to 2014. So, if the scale lies between the scale is larger than 1 is to 7 then we conscribe the scale large scale map and if the scale varies from 1 is to 12,000 to 1 is to 2400 then we share that this is the medium scale and if the scale is still smaller than one is to twelve thousand then we call as small scale now the significance of these terminology is that depending upon our purpose we as I have told you that we have to say whether we look the small scale or medium scale or larger scale.

Now, wherever we will go for high accuracy work we should go for large scale map like if you want to go for earthwork.

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Or if you want to go for building design or laying or any important construction work then you should go for large scale map, but when if you go for planning purpose then like a big huge amount of area is involved and we want to do in a (Refer Time: 16:35) in a closet like laying of a dam something like the reservoir. So, that case we should go for medium scale and in small scales generally we go for when the area to be considered is a huge area and we want to get a synoptic view of the area or very. So, many areas we have to take together then we will go for small scale mapping.

So, the depending upon the purpose we have to go defined types of scales, but one thing is important are also very very mach encouraging is that if we prepare the map in digital form then we can have our scale modified as and when required with the measurements taken are of very high quality. So, that that is the utility of digital and surveying and mapping that we pull the surveying we should take our data as best as possible or as best as available or the instrumentation methods and the resources and then subsequently we can make use of the data for the type of Mac and the scale of map class of map what about we require from time to time simply by using the different formats. So, that is the beauty and the advantage of having digital map. So, in 2 sense this thing have will not have much bearing on digital land surveying and mapping if we go for very sophisticated way of collecting the data using precise instruments.

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MAPPING FUNDAMENTALS

Plotting accuracy

- Accuracy of a map i.e., the smallest distance that a map can show is directly proportional to the scale of the map.
- Precision of the survey map depends on the fineness and accuracy with which the details are plotted.
- Plotting accuracy on paper depends on least dimension with which features in a map may be represented, varies between 0.1 mm to 0.4 mm, of which the mean value of 0.25 mm is usually adopted as plotting dimension.
- This imposes a limit on what linear measurements can be represented on the map at a given scale and with what accuracy the corresponding measurements be made on the ground.
- For example, if the plotting scale is 1: 1000, then the maximum possible distance on ground is 0.25X 1,000 mm i.e., 0.25 meter. Thus, any detail length less than 0.25 meter can not be plotted and thus, field measurement less than 0.25 meter are not needed. If the scale is smaller say 1: 50,000, then maximum plotable ground distance is 0.25X50,000mm i.e., 12.5 meter. Thus any object having length or width less than 12.5 meter, such as roads, railway track etc. cannot be plotted on map.
- Features, which are important details and can not be ignored, are represented on map by based on 'Principles of Generalisation of Details'.

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And then another point which is important about the map is that the accuracy as I have told you what is the accuracy of the map actually accuracy of map depends on what is the dimension of plotting or main adapting. So, also it depends on scale. So, scale and the dimension of plotting or graphics is called these 2 provides the accuracy of the map. So, whereas, I have taken example using a dimension of 0.2 millimeter to represent our object and the scale of the map is 1 is to 1,000. So, what will be the least dimension of the object we will be able to represent simply we multiply this thing; that means, 200 millimeter. So and 200 millimeter means 20 centimeter; 0.2 meter. So, that is the least dimension of the object least dimension of the object least dimension of the object which we will be able to represent in that map.

So, this is the this is the accuracy of the map of the position with which we can represent the map or object in the map now you can see here that depending upon what will be the dimension of the object for our purpose indirectly because this is the dimension of the plotting of this more or loss it is constant because the if we go for automated presentation or computer oriented there is a restricted dimension to which we can go for. And also if we natives of with still smaller maybe sometimes we will not be able to recognize it. So, maybe 0.2 millimeter dimension if the there is a point also we will not be able to reorganize, but if there is a line of 0.2 millimeter dimension then we will be able to reorganize. So, also that is another important factor we cannot arbitrarily take the dimension of plotting for point we can take what to take a bigger dimension for line we

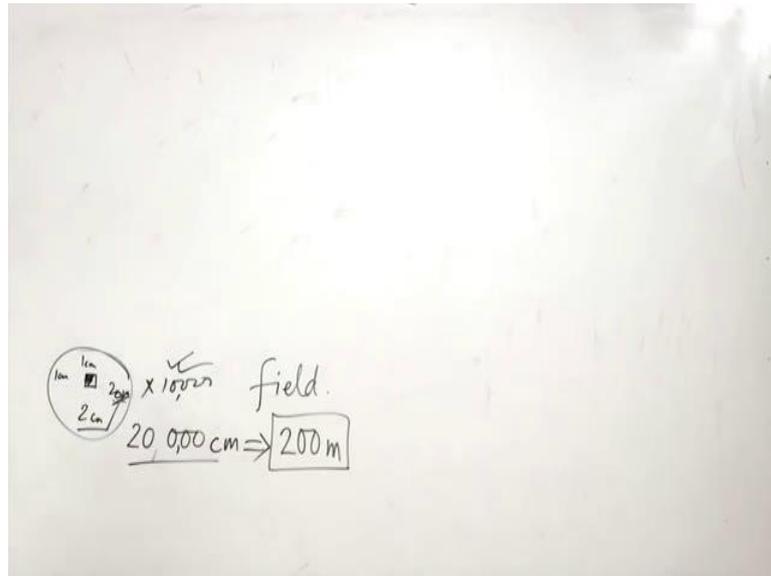
can go for smaller dimensions, but the dimension that should be perceptible to human eye. So, in this way we can restrict the dimension of the object which will be able to require from the field during our survey.

So, before we go to the field to for our surveying walk we need to decide the scale then only and also we should have the knowledge about the dimension of plotting and from these tool we have to coordinate and to find out what should be the minimum dimension of the object which will be able to acquire from the field now sometimes we will find that some of the objects even smaller than the minimum permissible object dimension, but some of the objects still we will be in need to take a take up because of the requirement of our project, but suppose by scale of the maps (Refer Time: 22:18) let us take this scale of the map is 1 is to 10,000 then the dimension of minimum dimension of the object will be 2 meter.

Now, if we have if we want to carry for road project and you will see in the village we will find many of these roads having dimension less than 2 meters, but these are the roads which we like to show you know why map because we are carrying out the surveying for way project. So, what to do? How to do? So, that is then they realize the concept of generalization of detail and if we go and most of the objects or features that is available on the surface of the earth many of the theme many of the objects we have to represent in the map and generally we represent the objects in the map using some symbols and symbols we have some dimension.

So, if the dimensions of the symbols are more generally dimensions of the symbols are will be much bigger than the size of the object. That can be represented in the map now if we consider an object which is having a symbol dimension of 2 centimeter by 2 centimeter.

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Now, for a scale of map 1 is to 10,000; the size of the object will be 20,000 centimeter which is equal 200 meter in the field. Now field and hardly there is any object like road railway line many other important thing which really we will like to have in our map having the dimension more than 200 meter. In fact, in most of the objects we will be having dimension less than 200 meter. So, under those circumstances we will not be able to depict these objects, but these are important for our purpose of the work. So, solution lies in generation of details.

Now, what is that generation of detail in generation detail we do enforces better enforce to the objects or information which are important for us and we without the information which are not required for the particular purpose for which we are going for surveying. So, the representation of important feature is done by the conventional (Refer Time: 25:03) I have discussed.

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MAPPING FUNDAMENTALS
Map Generalization

- Since a map is a representation of earth's surface features on a smaller scale, it cannot be an exact replica due to extremely limited space available for showing all that lies on the surface of the earth.
- It is essential to show the important details and weed out the trivials.
- The process of selecting essential details from the multitude of topographical features and representing them in a specified manner is called 'generalization'.
- Generalization serves the purpose of facilitating the production of a legible homogenous map.
- Moreover, when the representation of an important feature is done by its conventional sign, it occupies more space on the map sheet than what the scale permits. This space occupied by the conventional sign may require cutting down of some other details known as "generalisation of details" on maps.
- The salient points required for generalization are:
 - choice of features in connection with its purpose and the scale of map;
 - Elimination of terrain details that cannot be maintained because of legibility and clarity in the map;
 - Simplification of the form of terrain details that cannot be omitted but of which a detailed representation would interfere with the image of the map.
- A topographical map or even a large scale Engineering survey map, therefore, may not contain all the details those are present on the actual surface of the earth.

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So, the salient points required for generations are choice of features in connection which is purpose in scalar map elimination of talent details that cannot be maintained because of the eligibility and clarity in the map and significance of the form of talent details cannot be omitted and part of which detailed the presentation would interfere with the image of the map. So, a topographical map even a large scale engineering survey map therefore, may not contain all the details that are present on the actual surface of the earth.

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Summary of Lecture 31

1. Primary objective of surveying is to prepare plan or map.
2. Map is a presentation of 3D earth surface on a 2D plane surface.
3. Map scale is the most important consideration for map making.
4. Map scale is to be chosen after taking into consideration of different conflicting factors.
5. Based on scale, there are three classes of map: Large, medium and small.
6. Accuracy of a map depend on its scale.
7. Objects or features are mapped based on the concept of "Generalization of details."

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So, with this is I like to conclude today's class on the summarizes of this today's class is that the primary objective of surveying is to prepare a planar map is nothing, but a 3D object will present in a 2D plane surface of the different characteristics of map. The map E scale is the most important characteristics or considerations to be done map scale is to be chosen after taking into consideration of different conflicting factors like natural terrain scale purpose and all these thing based on the scale mountain scale there are 3 classes of map like large scale map, medium scale map and most small scale map and the accuracy of a map depends on the scale chosen for it and many of the details on the surface of the earth.

The details that were present on the surface of earth has to be considered under the concept of generation of detail to omit or to maintain in the map with this I like to conclude today's class, next class I will like to talk on some basics of mapping.

Thank you.