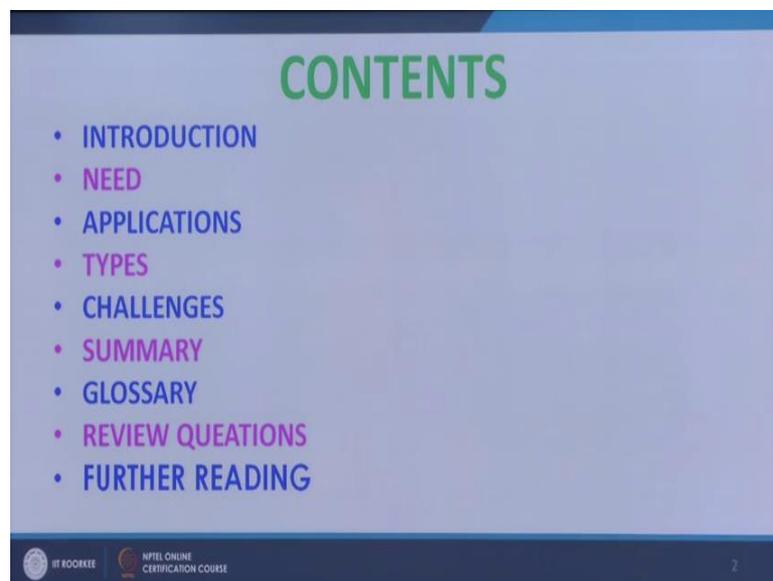


Digital Land Surveying and Mapping(DLS&M)
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Indian Institute of Technology, Roorkee

Lecture – 01
Introduction and Applications

Welcome students, this is the first class on Digital Land Surveying and Mapping. Today I will be discussing on digital land surveying introduction and application.

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So, under this I will be discussing these having the topic, I will first like to discuss the introduction then I will discuss what is the need of these course of this subject and then the salient applications of the subject and then different types of these surveying and then what are the modern challenges. Followed by the summary of this course of this class and for you some glossary and review questions are given so that you can prepare yourself next.

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The slide is titled "INTRODUCTION" in green capital letters. It contains a list of seven bullet points in blue text. At the bottom left, there are logos for "IIT ROORKEE" and "NPTEL ONLINE CERTIFICATION COURSE". At the bottom right, there is a small number "3".

- Surveying is defined as the science of making measurements of the earth specifically the surface of the earth.
- This is being carried out by finding the (relative) spatial location of points on or near the surface of the earth and to represent these on a plan/map.
- Developments in different branches of science and engineering caused development of techniques and instrumentations in surveying in an enormous pace.
- New technologies result in changes the way engineering surveying is being carried out.
- Advances made in surveying are making it possible to collect, process and display large amounts of spatial data with relative ease using digital technologies.
- Large data get processed through computers which can receive, manipulate, process, reduce, manage, store data quickly and efficiently.
- Further advantage of digital land surveying is capability to transmit data between instruments and office using information and communication technologies.

So, digital land surveying and mapping the word main thing is that surveying what is surveying? Surveying is the science of measurement of the surface of the earth. Now in doing that what do you do we generally find out the position of some salient points on the surface of the earth or near the surface of the earth and then we represent that points on a piece of paper or map which is finally, called as map.

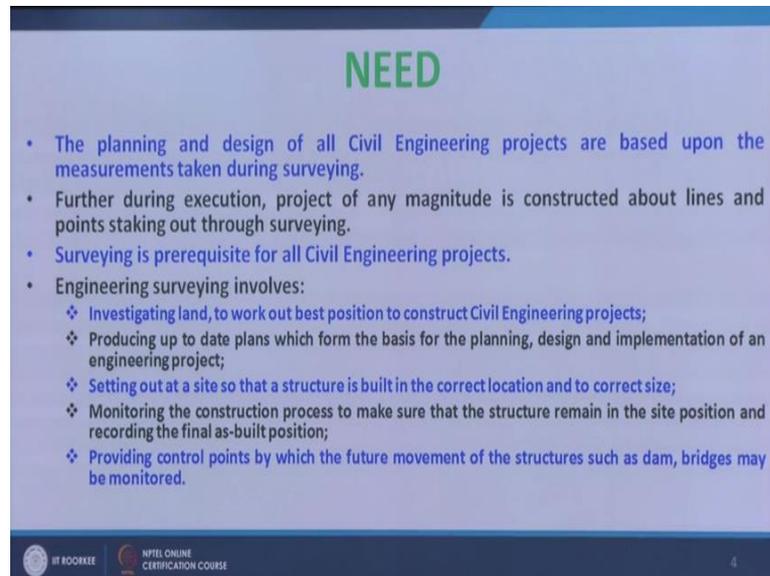
Now, at present there are. So, many developments takes place about the instrumentation and subsequently the techniques which we apply for the surveying work and new technologies are coming day by day. So, the surveying the method of surveying the instrumentation for surveying is changing a lot over period of time and we are found that now with the present kind of instrumentation available and the methodology available a large amount of geospatial data; that means, surveying data can be a quite them process using digital technologies.

So, now we emphasize on carrying out or surveying of using the digital instruments or digital based collection in processing and everyone know that we computer can collect process and display large amount of spatial data with relatively is and weekly and efficiently.

So, the digital mode of instrumentation followed by the computer processing is the state apart of today. So, in this course we will like to learn how to collect and then subsequently process collect the data using the digital mode like GPS and total stations

and then subsequently we will like to download the data to the computer to process it through use using some software and subsequently to prepare the map.

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The slide is titled "NEED" in green text. It contains a bulleted list of points explaining why surveying is essential for civil engineering. The points are:

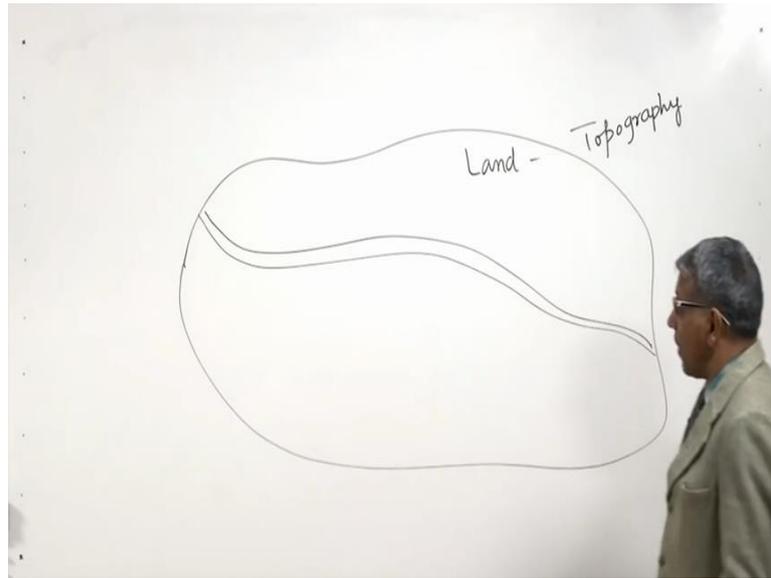
- The planning and design of all Civil Engineering projects are based upon the measurements taken during surveying.
- Further during execution, project of any magnitude is constructed about lines and points staking out through surveying.
- Surveying is prerequisite for all Civil Engineering projects.
- Engineering surveying involves:
 - ❖ Investigating land, to work out best position to construct Civil Engineering projects;
 - ❖ Producing up to date plans which form the basis for the planning, design and implementation of an engineering project;
 - ❖ Setting out at a site so that a structure is built in the correct location and to correct size;
 - ❖ Monitoring the construction process to make sure that the structure remain in the site position and recording the final as-built position;
 - ❖ Providing control points by which the future movement of the structures such as dam, bridges may be monitored.

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Now, what is them before going further to how it is done we should know really what is the need for surveying in our present day life especially for engineers especially for civil engineering projects we need to first know about the surface of the earth; that means, what is the variations of the surface of the earth what is a height? What is the extent of it is how extent it is varied all these things we need to know for civil engineering project first this is the thing then we need to know after we know and this is known through surveying.

Now, when we do carry out surveying we do first take out the location of different points then we prepare a map of that area that on that map we do go for planning of civil engineering projects then we go for design of that civil engineering work of project. And subsequently wants the planning and design has been done then again you have to come back to the field to transfer the designed layout or whatever design extension spatial extent on the field and that is also to be done by using surveying work that is called staking out operation.

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So, the engineering especially civil engineering surveying work engineering survey that is called engineering survey engineering surveying work first we investigate the land to investigate the land to work out the best position to construct the civil engineering projects suppose there is an area big area. So, first we need to know what is the condition of this land and we call it the topography we need to know once we know it suppose we want to construct a road suppose this the alignment along which we are plan to construct the road. Now once we plan it in the map then again we have to go into the field to establish this road in the field that is called stacking out. So, all these work we need to do and we will do by using surveying work.

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APPLICATIONS

- To fix the national and state boundaries;



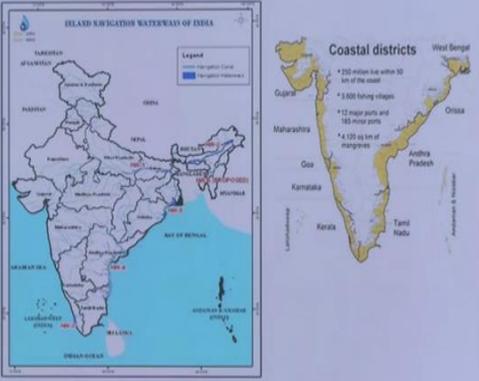
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Now, some of the salient applications of surveying that has to be that has been done or we do consider the boundary of the country also the boundaries of the states all these has to be done by using surveying.

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APPLICATIONS ...

- To chart coastlines, navigable streams and lakes;



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So, then if we want to know what is the coastline and then what are the waterways and out of these waterways which are navigable which are not navigable all these information we do extract through surveying.

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APPLICATIONS...

Hydrographic and oceanographic charting and mapping



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Then one more application that has been shown here is the hydro graphic surveying now hydro graphic surveying means the surveying in which we do not about the amount of water it is depth extent of the water. So, that is hydro graphic surveying now in this picture you can see and if this generally hydro graphic surveying associated with small water bodies like lakes or river and when we do the same wave in ocean that this is called oceanography. Now in case of ocean the depth of water will be much more and the variations will be more. So, it has been categorized into defined name. So, all these wave we can do using surveying.

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APPLICATIONS ...

- To prepare topographic map of land surface of the earth.



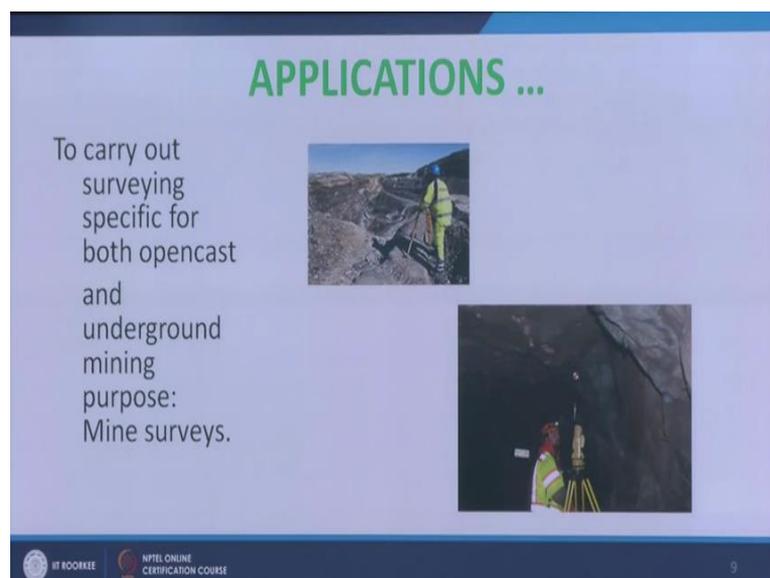
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Now, the most important and most prominently we do carry out surveying is for topographic surveying now what is topographic surveying it is the method of surveying in which we do find out the location of different objects like here you can see the this is the red line which is the village road or some road having no metal there are some this is the this is the black line which is the railway line then you can see this blue line which is the river water then these lines that consecutive lines these are called contours and there are. So, many built up areas you can see the villages in the red spots then like this black line small small these are the valleys along with the water will flow and will come to Main River.

So, all the detail we do carry out during the topographic surveying and that gives powers as the basically topographic surveying is to locate the permanent objects and to have the height of different points from the different heights of different points we do interpolate to get these control lines and this control lines provides as the rig line or the valley line then also the location of other details.

So, actually surveying in case of civil engineering we are mostly concerned or we mostly work for topographic surveying and the product this is the topographic map which has been produced after taking the field measurement and then going for mapping purpose.

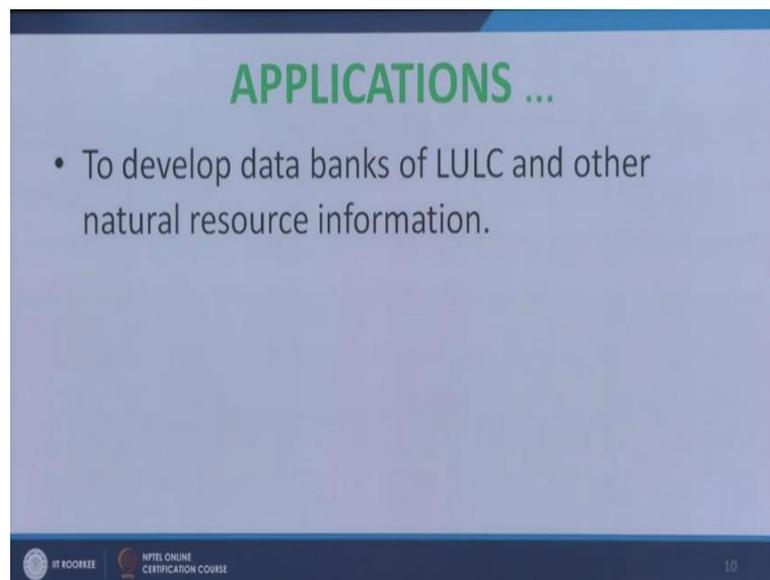
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Another area which is where the surveying is being used extensively it is the mine surveying now for mine surveying it can be done there are 2 ways we know that mines

are some mines are a opencast mines; that means, the minerals are available on the surface of the earth and in that case we go for opencast surveying for opencast mining and that gives us the various feature of the mines the amount of mineral that will available and. So, many other things and many mines are available underground. So, also we carry out surveying inside the underground mines. So, these are the various sub salient applications where surveying is being used.

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Another area nowadays where surveying is being used to develop the data bank; that means, we need to develop a card or depository where we need to store the data about the different objects of features on the surface of the earth like land use land cover map other natural resources and information. So, these can be done by using surveying

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TYPES...

- Route survey: To plan, design, and laying out of route such as highways, railways, canals, pipelines, and other linear projects.
- Construction surveys : Surveying for establishment of points, lines, grades, and for staking out engineering works, after the plans have been prepared and the structural design has been done.
- Hydrographic survey : To define shorelines and depths of lakes, streams, oceans, reservoirs.
- Astronomic surveys : To determine latitude and longitude of a station, azimuth of a line and time of any instant from astronomical observation.
- Mine surveys : To carry out surveying specific for both opencast and underground mining purpose.

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Control Point → Station/points having known location

Land surveying →

Topographic surveying → planimetric location of objects on the surface of the earth & their elevations → Contours

Contours

The whiteboard also features a diagram of a rectangular area with several 'x' marks representing points and lines connecting them, illustrating a surveying layout.

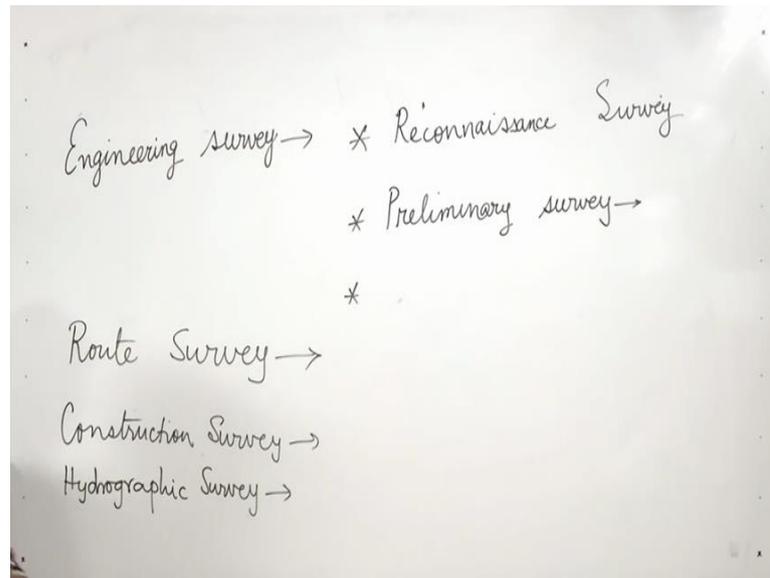
Now, there are different types of surveying depending upon what are the different types of work we do during surveying or what is the purpose of doing some surveying like if we want to establish the control point. So, control point now what is control point control points are the station or points having known location. So, if we want to establish control point means if we want to find out the location of any points or if we want to establish the location of any points that type of surveying is called control surveying. So, in sometimes we do carry out surveying to establish the control point and that is called control surveying.

Now, sometimes we need to move the different parcel of lands the boundaries of different properties. So, in those cases the methods of surveying or the surveying we call go for that is called land surveying. So, in land surveying we do find out the boundary or the parcel of land we do find out the area of parcel of land we do find out the different land cover types or area of land covers like that.

Now, another surveying which is very important of which is being done very frequently that is called topographic surveying as I already told you in topographic surveying fundamentally we do go for planimetric positioning of planimetric location of location of objects on the surface of the earth and their elevations along with many other elevations. So, suppose; however, an area where there is a river and then road then tree is there then there may be a building something like that. So, in this case what we will do we do find out the location of some salient points along roads like this and then if we join the location of these points we will get the road similarly for regular geometric figure we can get the corner and if you join we will get this building then location of this tree and now we also want to know how the terrain is varying the height is varying. So, for that we need to have the height of some salient points all throughout.

So, and this point should be while distributed and whatever there is some more variations there should be more closure points like that some. So, when we know the elevation of all these points now between then we will write develop the contours in between these elevations to represent the nature of the terrain. So, from elevation we will get contours. So, the planimetric position of the objects along with the contours define the topographic map as I had shown you earlier this is the topographic map, this is one of the topographic map of an area.

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Now, surveying is also carried out for engineering purposes that is called engineering project work that is called engineering survey now engineering survey when the surveying is being carried out for any engineering project. So, in engineering project surveying is done on the three steps first step is called reconnaissance survey now during reconnaissance survey a survey goes to the project area and then collect different information about the area. So, that he can plan for subsequent actual surveying then after reconnaissance survey we do collect the preliminary data and then we do plan our work then we go for preliminary survey during preliminary survey we actually collect the different measurements or data about the surface which is of our interest for the project.

So, actual feature being work is done during preliminary survey and once the data has been collected during preliminary survey, we come back to the office and we process the data we find out the different parameters we prepare the map on that map, we do layout they say engineering (Refer Time: 19:59) than we plan design and once this has been designed properly again on that map we do actually set our project and will be find out the salient point suppose we want to construct the building of rectangular shape because I am taking very simple case then within this area this is the location where we will be getting our building. So, now, in the office we will like to determine also the location of these points.

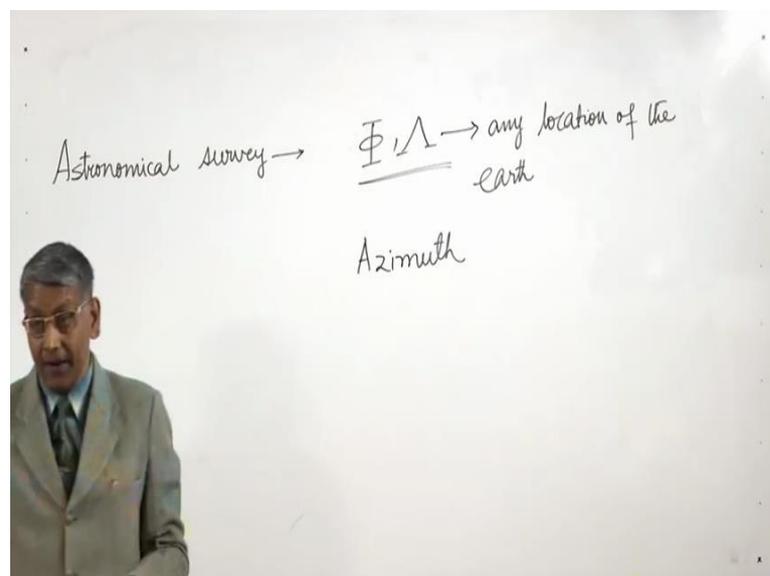
So, once it is known from the map what is the location of this then again we will go back to the field and we will transfer this location in the actual field that is called staking out operation or also called set out work. So, that is also a very big important step to be done during over in engineering project and that is also done through surveying.

Next if the engineering survey is particularly done for laying out a route, route means like road, railway line, it may be canal, it may be pipeline. So, that is called route survey. So, the surveying which we do conduct to lay a route is called route survey in this also we have these three steps reconnaissance survey preliminary survey and then setting out or staking out operation.

Then construction survey when a construction work is going on we do also conducts surveying to monitor the progress of the construction work and that type of surveying is called construction survey also to find out whether the construction is going on at proper location or not whether the height is up proper height or the location of the different members are at appropriate location or not. So, many other things we do during construction work through surveying and that is called construction survey.

Then hydro graphics survey as I already told hydro graphics survey means it is the survey where we do find out the boundaries of the water bodies or the corners of the water bodies and then what are the different depths a different location of the water bodies and that is called hydro graphic survey.

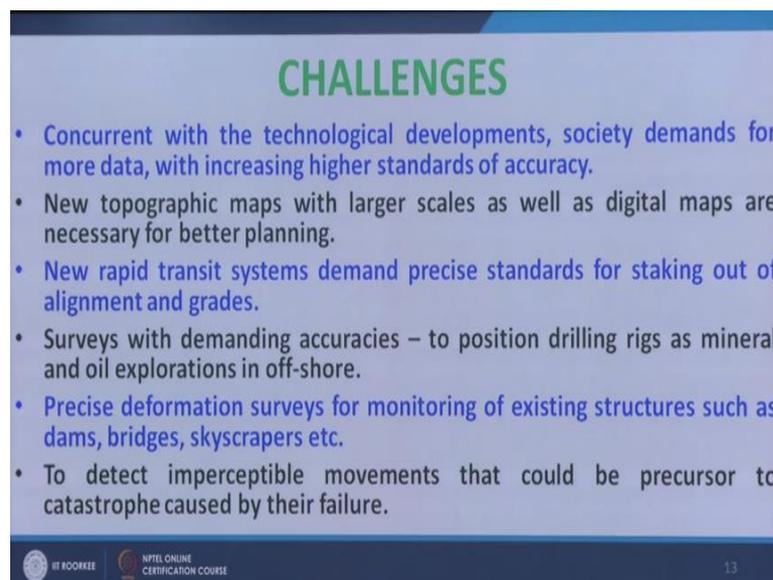
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Now, one more another important type of survey astronomical survey in which we do find out the astronomical latitude and astronomical longitude of any location on the surface of the earth any location of the earth from observation to the heavenly bodies. So, astronomical survey is primarily for astronomical latitude longitude as well as to get the azimuth of a line. So, of course, nowadays after the than the GPS it has become of low preference, but specifically for many other works still astronomical survey is important and the mine survey already I had shown in that we can carry out surveying in mines opencast mine as well as underground mines.

So, whatever is the purpose we will see that the surveying has some particular way to be done and some particular parameters to be measured and all these surveying can be done whatever we will learned in this course with some understanding to the purpose for which you have to do the work you can do the work.

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CHALLENGES

- Concurrent with the technological developments, society demands for more data, with increasing higher standards of accuracy.
- New topographic maps with larger scales as well as digital maps are necessary for better planning.
- New rapid transit systems demand precise standards for staking out of alignment and grades.
- Surveys with demanding accuracies – to position drilling rigs as mineral and oil explorations in off-shore.
- Precise deformation surveys for monitoring of existing structures such as dams, bridges, skyscrapers etc.
- To detect imperceptible movements that could be precursor to catastrophe caused by their failure.

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Now, as I told you that the surveying is a very old science and subsets subsequently it is developing and it is nowadays days it has developed in a very technology it is technologically it is highly developed. So, as the developments are going on also society has a more demands on us to have more and more amount of geospatial data and quality of data should be better and better; that means, we want; we need to get more accurate location. So, this is a very big challenge for the surveyor to collect a large amount of data in a less amount of time as well as very accurate data.

Further nowadays we need to have topographic maps having larger scale and then also digital maps. So, because we are now going more to digital platforms we are trying to analyze many of the activities or we are planning many of the works in digital platform. So, more and more digital maps are important and required. So, that is also a challenge. So, this course we have developed so, that you can do some really good work which will be useful for Indian society for matching towards digital India.

Another thing is coming up in India is the rapid transit system and for rapid transit system we need very accurate staking out operation and that is also a challenge with this modern development then drillings rigs oil exploration off shore all these needs very accurate location because otherwise a lots of caused are involve in digging the offshore oil fields. So, if we go by some few meters also a lot of money will get spoiled if it is not correct, so their demand very accurate location.

Then deformation nowadays many structures are getting deformation we need to want to know what is the amount of deformation whether it is acceptable limit or not for that reason we need to go for instrumentation and surveying instrument may be used to find out those deformations very accurately and their demand the society demands to make use of instrumentation to get very precise deformation.

So, that is also a challenge then some moments like I or many of you must be knowing that Indian plate is moving to a China plate. So, as a result of this earthquake is coming some other (Refer Time: 29:50) is coming lens that is could taking place. So, though it seems that we are in a platform means stable platform or plate, but actually we are moving this is not perceptible. So, do we need to know really how much you're moving and this can be done through surveying and this equal to be done through surveying and that is also a challenge for us to know and do go for.

So, with digital mode of surveying we can really face these challenges and that is the reason why we are looking for digital land surveying and mapping course and we have developed with an aims. So, that you student in future can face these challenges with full confidence and vigour.

So, with these I would like to conclude to this class before concluding I like to summarize what it is being taught in this class surveying is the science of measurement of the surface of the earth and it is being very useful or it is the most important and most

fundamental requirement for any engineering specifically civil engineering project; however, that is the reason why these surveying is developing a new technologies are coming new methodologies are coming and as per the new challenges and demands of the societies; that means, they have a large amount of data in a less amount of time more accurate data and that has to be processed nicely and to have a digital map large scale map digital data. So, all these thing has pushed us to go for digital land surveying work.

So, with this I like to conclude this class and I had included the gallery as well as review questions for you to study and if you want to know more about this class you can go through these 2 books.

Thank you very much.