GPS Surveying
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Lecture – 04
GPS Receiver

Welcome friends. This is the 4th class on GPS Surveying. Today I am going to discuss on GPS receiver. Now users receives GPS signal from satellite vehicles and this signals are often having very low power as well as it get merged with interference from more powerful signals. So, to make these signals useful we have to undergo many operations on this GPS signals within the GPS receiver. Now, a GPS receiver primarily composed of 3 primary elements; the antenna, a controller, and a receiver hardware.

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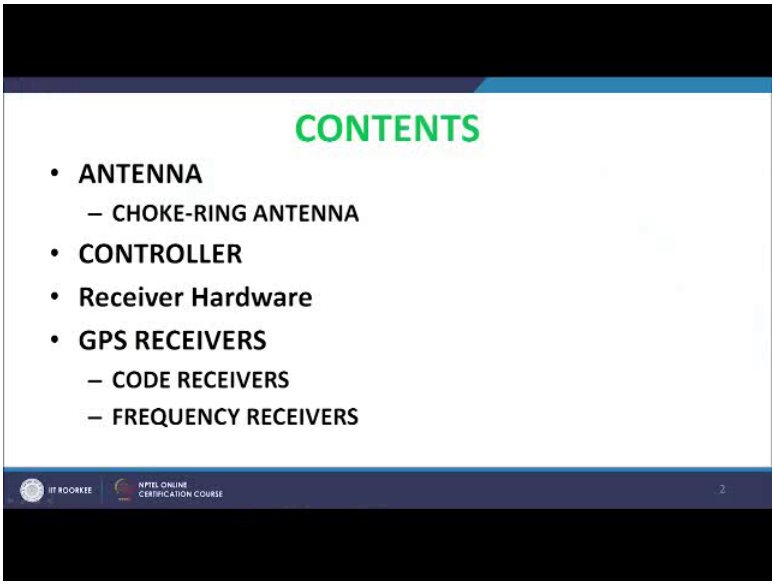

So, today's class I will discuss on antenna followed by controller and GPS hardware receiver and finally on GPS receiver.

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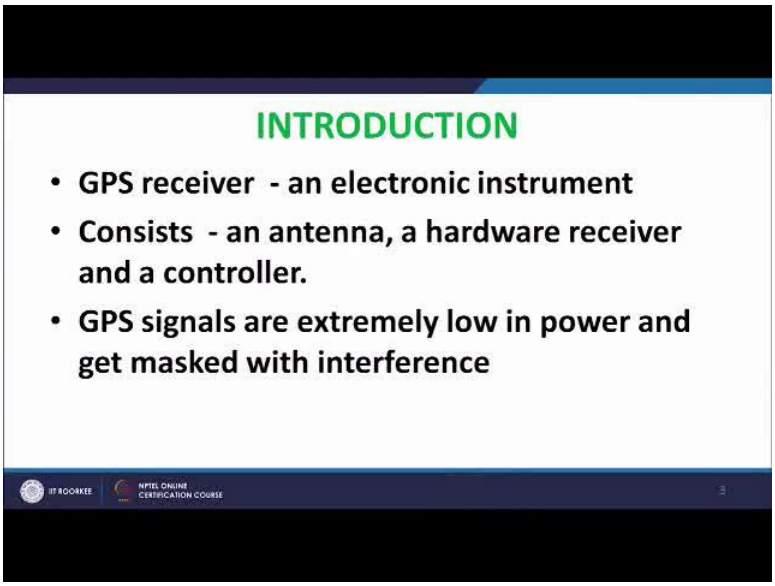

Now as I told you GPS receiver is an electronic instrument it consist of an antenna, a controller, and a hardware receiver.

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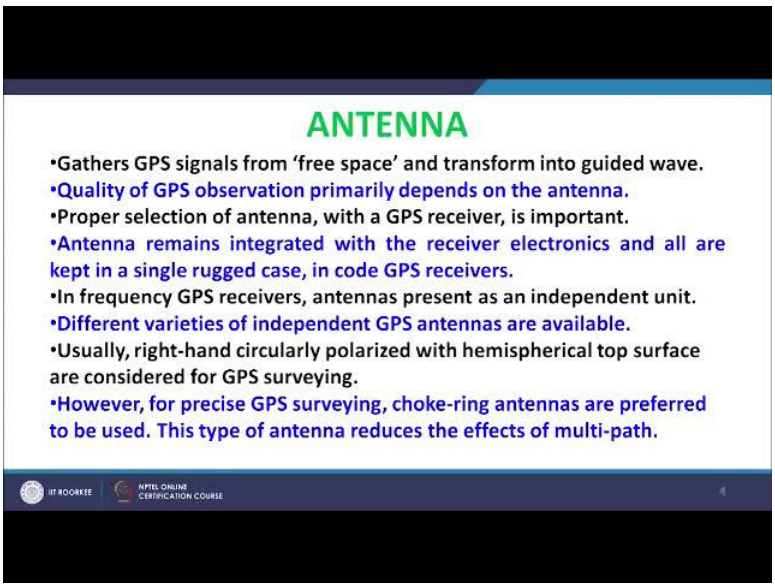

Now the antenna is used for gathering the GPS signal out of the lot of many electromagnetic signals that are available in the atmosphere. Once it gathers it transfers the signal to the GPS receiver hardware. Now the quality of the GPS signal that depends on the characteristics of the antenna which we will be using along with the GPS receiver. So, the antenna to be selected for use with along with GPS receiver is very important.

Now, this antenna is available in different forms and commercially available in different either it is available in an independently. That means, exclusively we can have the antenna to be attached to be GPS receiver or in some cases GPS antenna is available along with the GPS receiver.

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Now, let us take this case this is a GPS receiver where antenna is encased with in the same framework of the electronic hardware along with receiver and controller.

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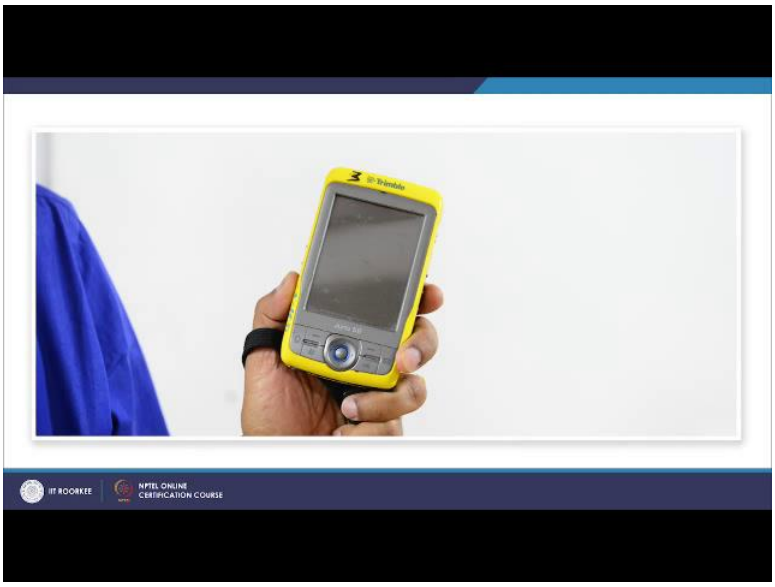

This is another GPS receiver where also antenna is embedded inside this case along with the controller as well as receiver.

Now, this is an antenna which is attached with only receiver, so no controller has been received with it connected with it.

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So, again this is antenna which is connected to GPS receiver, but controller is not associated with it. Now there are different antenna available in the market which is independently available which we can make use along with receivers and controller by using some connectors.

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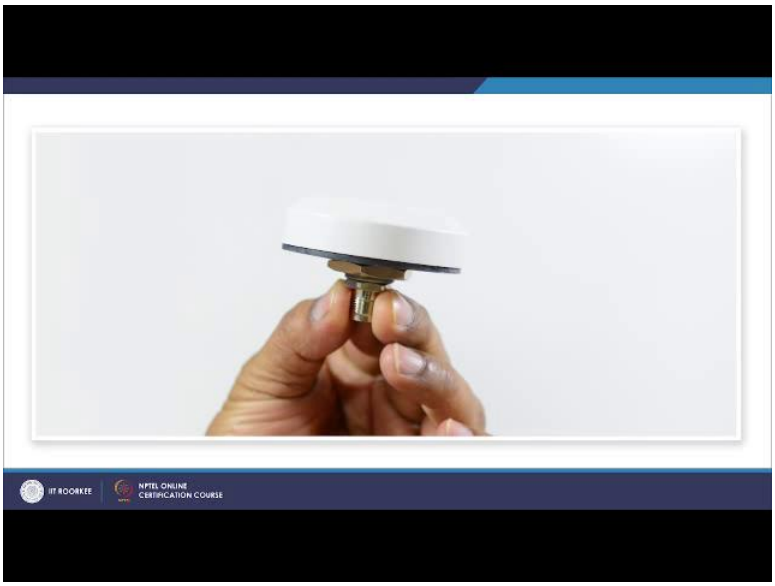

Example let us see if these antennas, this antenna are an independent unit which can be fixed with the receiver or the controller using this connector.

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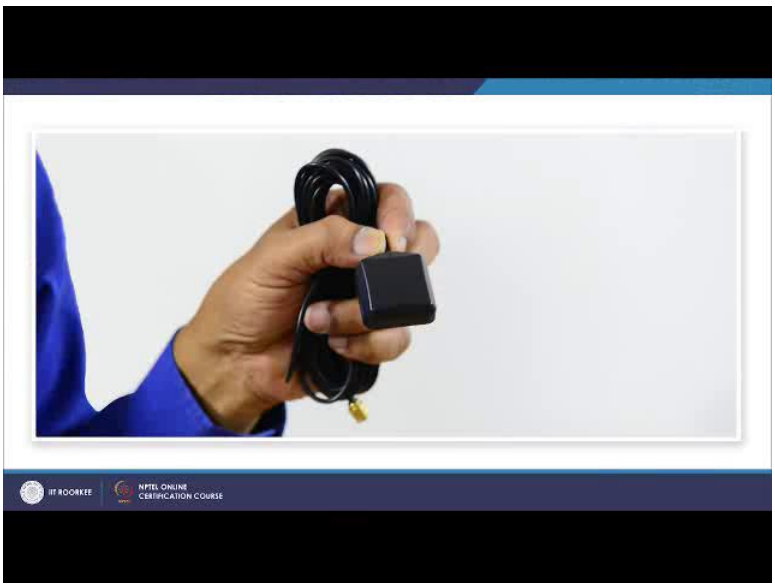

So this is another antenna is this small antenna having a long wire. And this is a connector, through this connector we can connect with the receiver or controller.

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This is again an independent antenna. Like that there are so many antennas available in the market which may be useful for our GPS surveying, but we should be very much careful about compatibility between the antenna you will be accepting or will be choosing for a particular type of receiver. Now for GPS surveying it has been found that the antenna having dome shaped will be of good quality and will generally prefer right hand circularly polarized antenna.

So, whenever you will purchase an antenna for the GPS surveying one should look for this quality that the specifications says that the antenna is right hand circularly polarized as well as it is shape is dome shape top.

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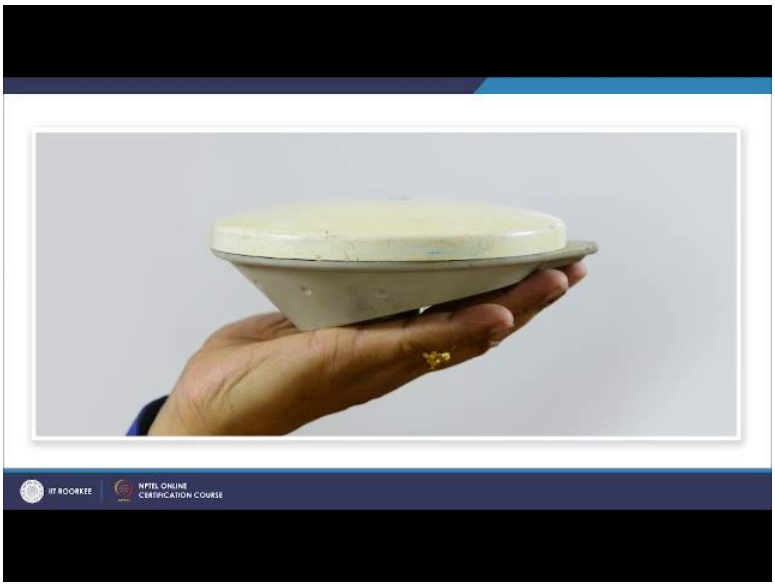

Let us say this is an example, this is an antenna where you can say the shape is dome shape and inside it is a circularly polarized which it is specification will tell, you will not be able to see from outside. Moreover for very precise GPS surveying actually you should go for still better type of antenna which is called known as geodetic geo free antenna.

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Like this one, where this is an antenna also again for GPS surveying and this is being used for very precise GPS surveying where the top of this is also a dome shaped and it is

circularly polarized right hand circularly polarized inside, so this is having very powerful it can receive very good quality GPS signals.

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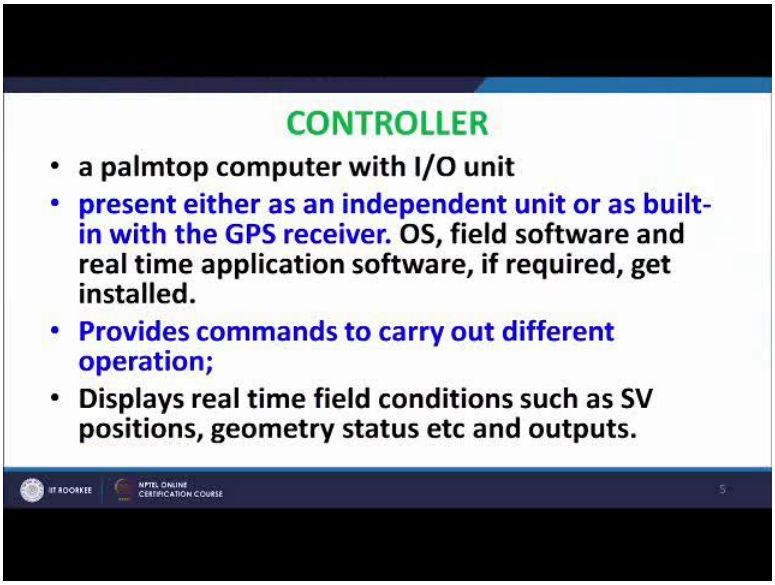

Let me now discuss on controller which is nothing but a palmtop computer having input output units. Now commercially the controller may available in different forms like it may available in an independent way. That means, it is independent of receiver as well as antenna or it may be associated with receiver or it may be integrated with receiver as well as antenna.

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Let us show some example. Now this is a controller where the computer this is the input unit and this is the output display unit and this controller has to be connected to antenna as well as to receiver independently, though connector using this input output ports.

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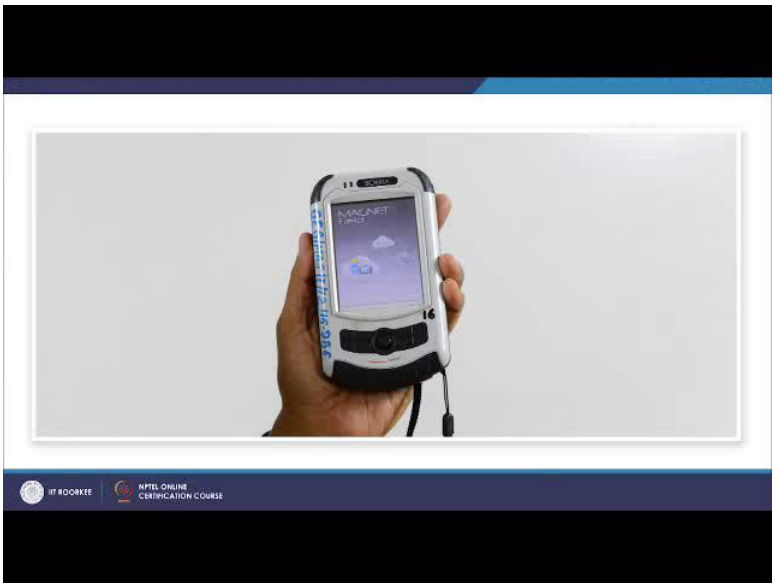

Now this is also a controller which is independent of receiver as well as of antenna.

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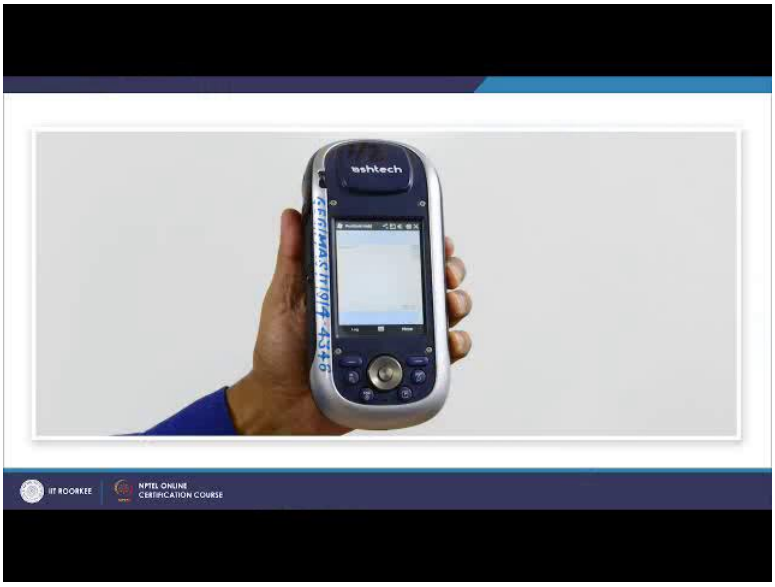

But, this is a controller also it is attached with receiver. Though it looks like same as before one, but it has GPS receiver associated with it. So, receiver as well as palmtop computer as well as the input device and output display unit.

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This is also a controller, where GPS receiver associated with it. So, it is an integrated unit of receiver as well as controller.

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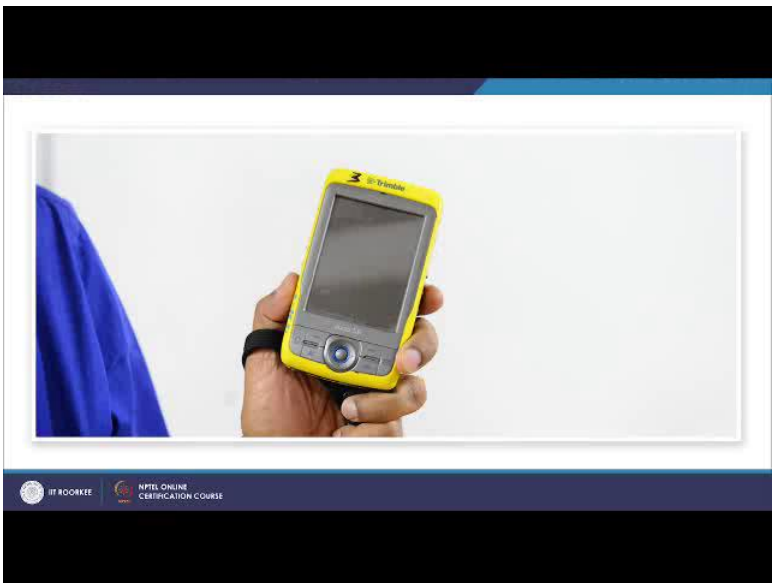

So, like these we may have now as I showed earlier this is a unit where antenna GPS receiver as well as controller having input unit, output unit is put together. It is an integrated GPS receiver. So, we get different types of controller were also available in the market.

Now these controllers are usually associated with all uploaded with different types of software. Operating system software, field software, and then now these softwares actually will be used for carrying out the work for whole of GPS surveying and through controller we do give the instruction to the receiver as well as to antenna, so this software using the connectors. And now we do carry out the GPS surveying. Also we can find out the condition of the GPS satellites using this field software. So, this will show how while demonstrating you the field activities.

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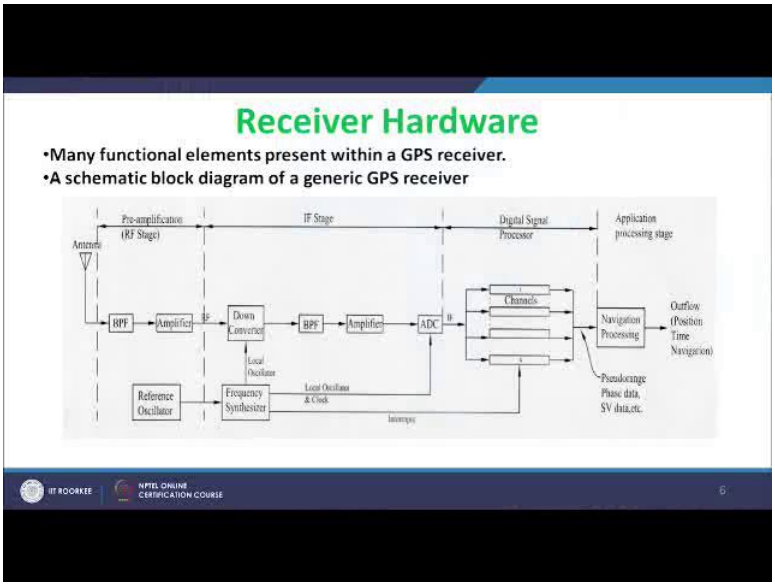

Next the GPS receiver hardware; actually as I told you GPS signals are very low in power as well as it get merged with interference from the higher powerful signals. So, we need to improve the power or in the signal as well as we need to filter the interference as well as we need to for the process the signal to get our desire parameters. In order to get those things the GPS receiver hardware contains filters, amplifiers, frequency unit, digital signal, processing unit.

As you understand from using filter it filters the interfered signals from the GPS signals then it will the amplifier amplifies the amount of power that is has to be associated with the GPS signal to be further processed in the next stage. In the in the frequency unit actually the receiver provides the refines frequency and time and then also it not only it also fills gave make some filtering as well as amplification then it converts the analog to digital signal, and also these signal that is received as an input also converted it to

intermediate frequency signal. That means the signal will be possible to be processed through digital signal processor.

Now, they bring a whole GPS receiver actually they digital signal processor it will break up the signal into different channels depending upon the different satellite vehicles and then process is independently for each satellite vehicle signal. And from that together they will provide thus receiver will provide some fundamental parameters like (Refer Time: 11:44) rate, then time tag, then navigational data which will further processed to use find out our position, time and navigation parameters.

So, now let me show you some of the GPS receivers, as I told you in case of antenna as well as our controller receivers are also either exists independently or it exists along with other part of the whole of GPS receiver. Like as I told you as I have shown you that in this receiver controller and receiver output together in this case also antenna as well as receiver is put together and in this case receiver is put together along with the antenna as well as the controller. So, these are generally of low capacity. However, GPS also exist as independent unit.

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Now, I can show a small GPS chip. This is the GPS receiver chip which is used to make some instrument using GPS receiver.

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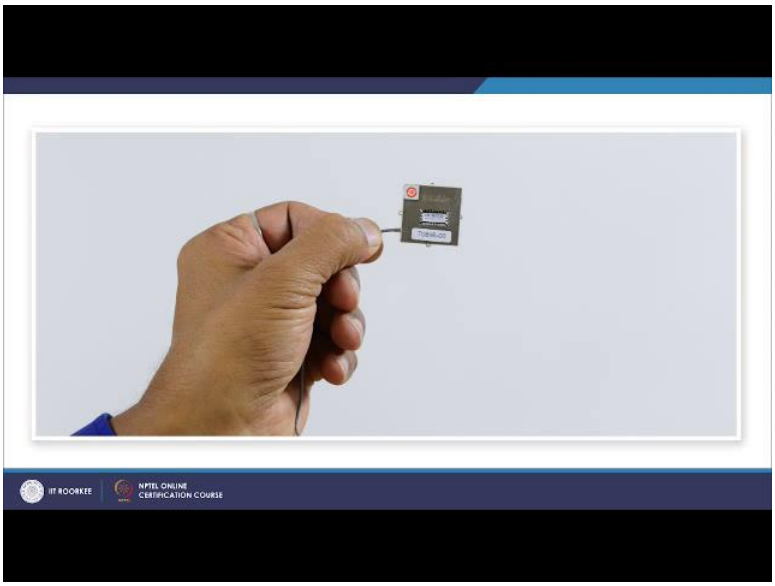

Another GPS receiver I want to show is this one which can be connected to antenna through this connector. So, this is a GPS receiver which we generally used for making independent instrument using GPS.

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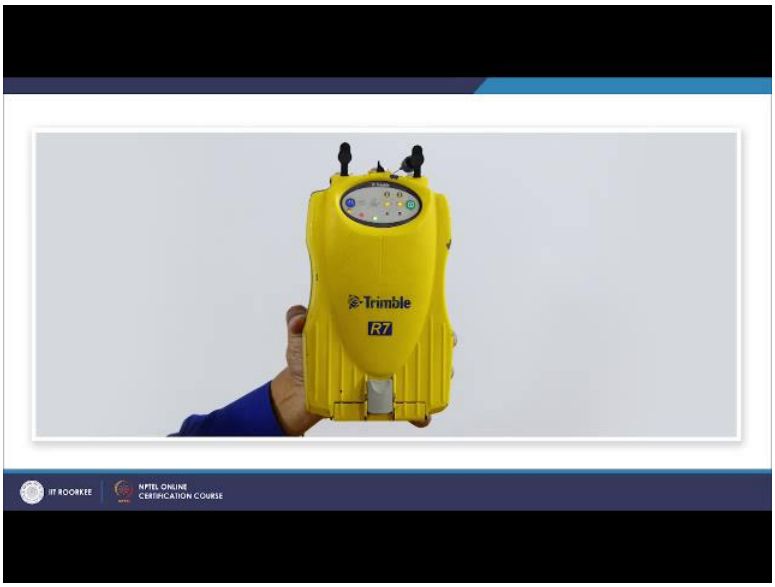

Now here is a GPS you see where which is being used as an independent unit for GPS survey. So, GPS receiver we may get either as an independent unit or it is associated with the other parts.

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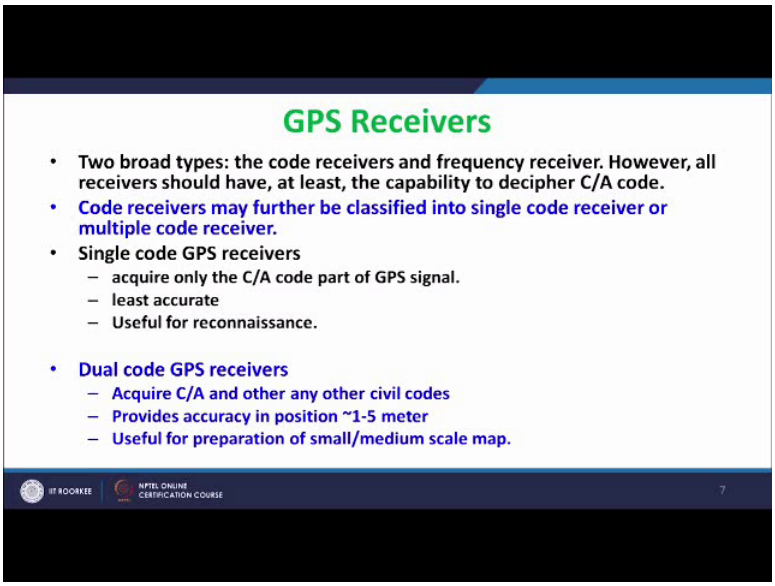

Now, let me discuss on GPS receiver as a whole. That means, I want to really take into antenna, controller, as well as receiver hardware together to work as GPS receiver. Now commercially there are different types of GPS receiver available and depending upon the accuracy how much it can achieve we classify the GPS receiver in the perspective of surveying into two types. One is that core type another is the carrier type.

Now under core type there are again 2 fundamental divisions; one is that single core type and another is dual core type. Now in a single core type receiver the GPS can decipher only the C A code. And this type of receivers are generally provides list accurate position and generally we use this type of receiver for recognizing survey.

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Now, let me show you one of the single code GPS receivers that would generally use for the recognizing survey is this one. However, there are hundreds of varieties of single code GPS receivers are available and most of the GPS enable mobile phones are also associated with C A code or single code GPS receiver.

Next it is the dual code or multi code GPS receiver. In dual code or multi code GPS receiver one of the code will be the C A code and other may be any one of the other civil codes like, it may be PY code, it may be CM code, it may be CL code, it may be high five code or Q 5 code. So, one thing is important to understand that whatever is the GPS receiver it must be or it is capable of deciphering the C A code. Because, C A code is the primary code most important means fundamental code which provides the identification of the signal from which satellite is coming also it provides the initial time measurement.

Dual code receiver or multi code receiver provides positional accuracy of the order of 1 to 5 meters and this type of receiver generally we use for small scale mapping purpose. Now, this is a dual code GPS receiver and this receiver may be used for mapping purpose.

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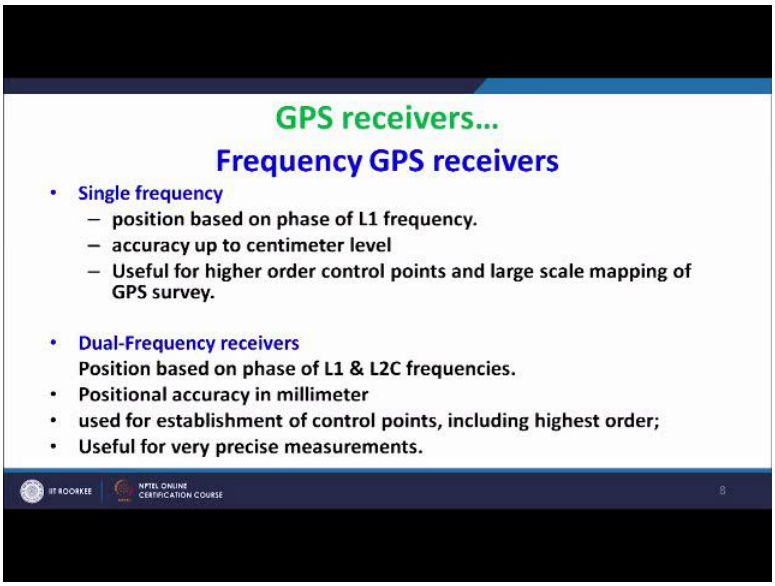

Now let me discuss on frequency GPS receivers. Now again frequency GPS receiver may be of different types depending upon how many frequency it can decipher. However, all frequency receivers in the beginning first it will decipher the C A code, from C A code only it will get the identification of the satellite from which the signals are coming and also it will get the time.

Now, the single frequency receiver works with the L1 C A signal. Now this type of receiver provides accuracy in centimeter level for (Refer Time: 17:31) positioning and decimeter level in high positioning. These types of receivers are useful for lower order control point positioning as well as large scale mapping purpose.

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Let me now demonstrated you the single frequency GPS receiver. Now here you can see a receiver where this is the antenna and this is the receiver and this is the controller. Receiver and controller are together and they are connected to antenna using a connector and they are mounted on a tripod stand. If we take these arrangements outside this room in open sky then through this antenna we will be able to get the GPS signal and recorded through this GPS receiver.

Now, let me discuss on dual frequency GPS receiver. In dual frequency GPS receiver we do analyze or we can get signals from L1 C A type, as well as either L2 C A or L5 signal. Now this receivers are quite accurate and very precise position it provides of the order of millimeter in (Refer Time: 19:00) position and sub millimeter in centimeter in vertical position. This type of instrument; that means dual frequency GPS receiver is used for highest order control points, highest order baseline measurements, than geodynamic activity, as well as for precise measurements of position.

Now, let me demonstrate you dual frequency GPS receiver. Here you see a dual frequency receiver where this is the antenna of the receiver and the receiver as well as controller is this one which is connected using a connector and it is been setup on a on this stand. Now if we take this instrument outside in open sky then it will be able to receive signals dual frequency L1 and l two.

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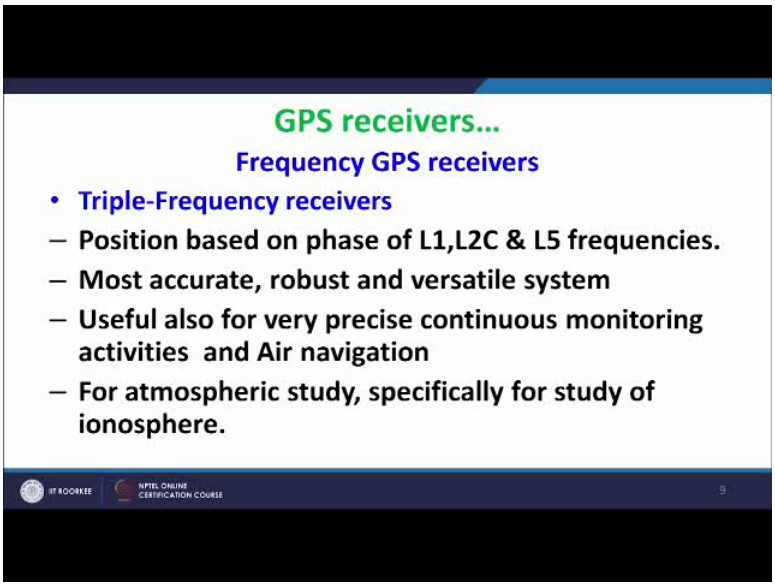

Next I will discuss on the triple frequency GPS receiver. This type of GPS receivers receives GPS signals and can decipher signals of L1 C A code, L2 C A, as well as L5 signal.

Now this is the most robust GPS receiver, because it can decipher all the 3 civil signals so it is versatile in nature. And this type of receiver provides very precise position. These receivers are useful for real time monitoring, well precise monitoring system. Then for continuous monitoring for air navigation and interrupted air navigation can be done by making use of this type of receiver, it is primarily used for atmospheric study because different type of atmospheric errors may be quite accurately measured by using GPS signals from this types of receivers.

Another type of GPS receiver nowadays widely prevalent that is called GNSS receiver; this type of receivers receives signals not only from GPS satellites, but also from other radio navigation system like GLONASS, Gallileo, Bido etcetera

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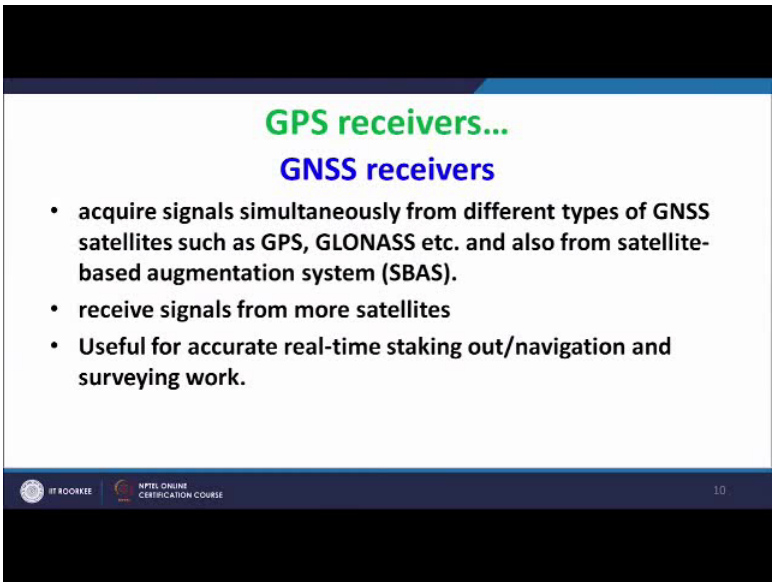

Now this type of receivers may receive signal from any combination like it may receive signals from GPS and GLONASS or it may from GPS and Bido or some other combinations. Now these types of receivers are most robust because they provide us information from different radio navigation system. So, there will be more much more useful for specifically for navigation purpose, air navigation purpose and real time staking out work, etcetera.

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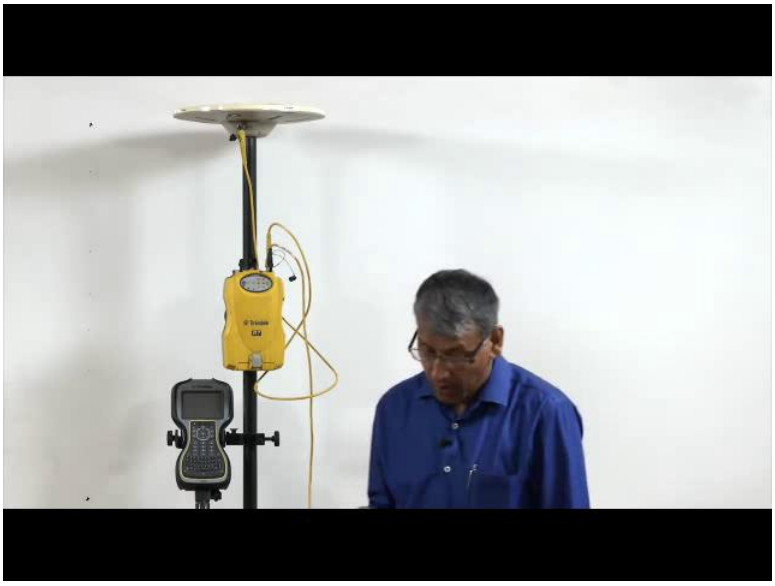

Now, let me demonstrate you a type of GNSS receiver. Now this is you can see this is the antenna geodetic geo free antenna. This is the antenna which is useful for very precise measurement of position and this is a receiver and this is a controller. Now in these cases you can see all the 3 units are independent to each other and they are connected using some connectors. Now this receiver can receive signals from GPS satellites as well as from GLONASS satellites as well as from SBAS satellites. So, this is a very powerful receiver. The signals can be useful for many precise measurement activities.

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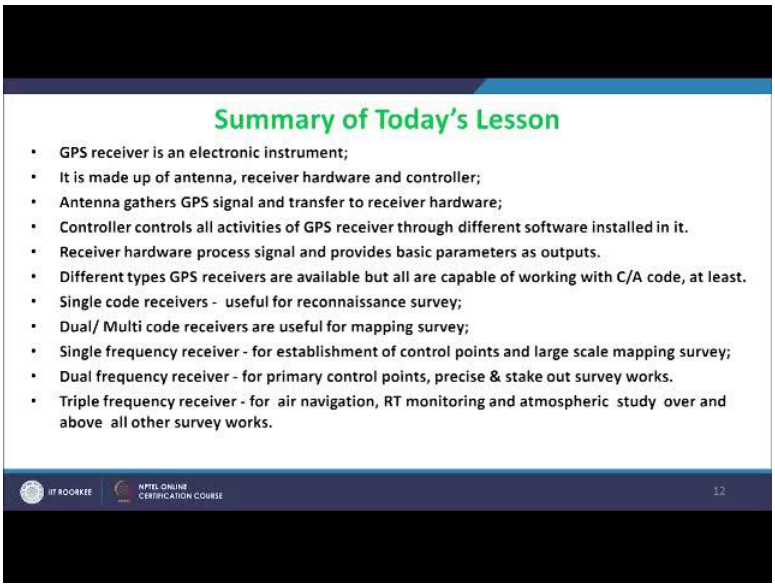

Now, let me summarize the total class. Today's class I had discussed about GPS receiver which is an electronic instrument. It consist of three basic components the antenna, the controller and a receiver. And they are put together through connectors and this receivers may be appear as a single unit or it may be a combination of different units which are which exist independently. Now the controller antenna receives the GPS signals and transfers it to the receiver hardware as per the instruction it receives from the controller. Controller also controls the GPS hardware receiver by making use of the software that is uploaded within it.

Now, the receiver receives the signals from antenna as per the parameters set by the controller and then it processes the signals and provides us the basic parameters to be used further. Now in commercially there are different types of GPS receivers are

available and depending upon the accuracy of the receiver we classify them into 2 types; in code type of receiver and the frequency type of receivers. Within the code type we get the single code which is least accurate and it is useful for recognition survey. Dual code receiver is useful for mapping purpose. Then single frequency we use for low order control point as well as large scale mapping survey. Dual frequency used for precise measurement, atmospheric study, as well as for navigation purpose. Triple frequency for continuous monitoring and very precise measurement staking out work.

And with this I like to conclude today's class. See you again in the next class. In the next class we will be talking on GPS Software.

Thank you.