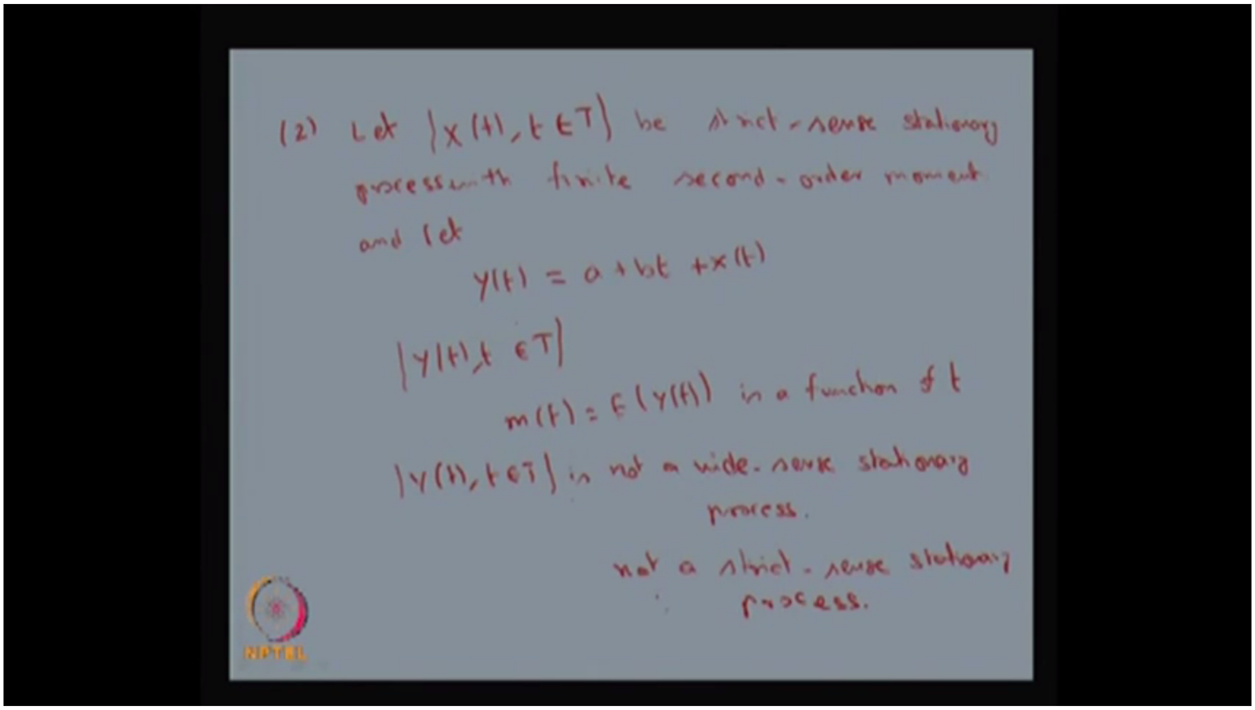
We will have another example in which it is going to be only the – it won't be a success itself let me start with the example in which this stochastic process is a strict sense stationary process in the given Xt is a strict sense stationary process with finite second order moment. So you don't want the finite a second order moment for the strict sense stationary process but I have taken as an example the given Xt is going to be a strict sense stationary process along with the finite second order moment.

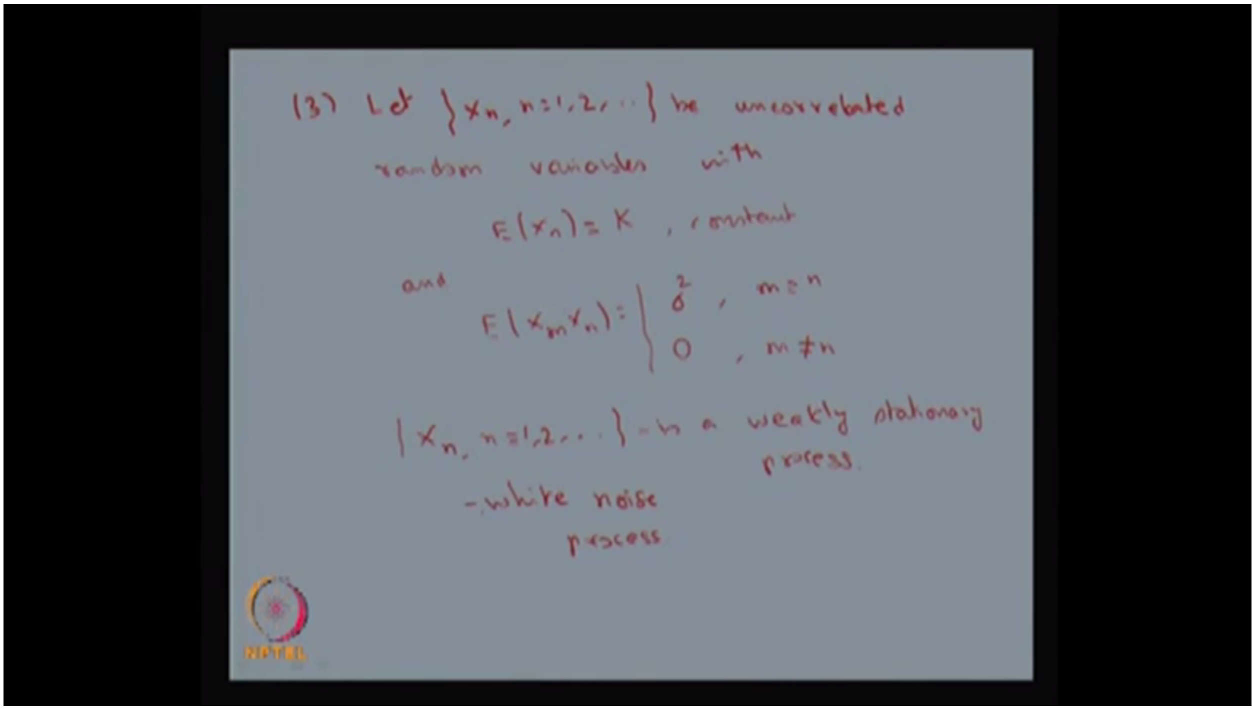
Now I am going to define the another stochastic process with the random variable Y of t that is a bt plus X of t. So this is going to be a stochastic process. This is a stochastic process Yt. Now we want to check whether the Yt is going to be a stationary – strict sense stationary process or not as well as whether this is going to be wide sense stationary or not. The Xt is a strict sense stationary process suppose you find out the mean for this random variable if you find out the mean for the Y of t where a and b are constant therefore this is going to be a function of t since a and b are constant the mean of Y of t is a function of t therefore this is a function of t since it is not satisfying the first property of the first condition to become a wide sense stationary process therefore the Y of t is not a wide sense stationary process. We started with the strict sense stationary process and we created a new stochastic process Y of t that is a plus bt plus Xt where a and b are constant. Now if you find out the mean of Y of t mean function that is going to be a function of t that is nothing but that depends on t therefore Yt is not going to be a wide sense stationary process whereas Xt is a strict sense.

Now similarly you can cross check whether the joint distribution of a Y of t shifted by h, t is shifted by h you can conclude this is also not going to be a since it is a function of a t since it is the mean is going to be a function of t and Y of t also involves the function of t as well as X of t even though X of t is a strict sense stationary process the way you made a plus bt plus Xt you will land up the joint distributions are going to be different by the t with the shifted t plus h it won't be satisfied. Therefore you can conclude Y of t is not a strict sense stationary process also. That means from this example we can conclude whenever you have a strict sense stationary process if you make it a plus bt plus Xt definitely the Y of t is not going to be a wide sense stationary process as well as a strict sense stationary process.



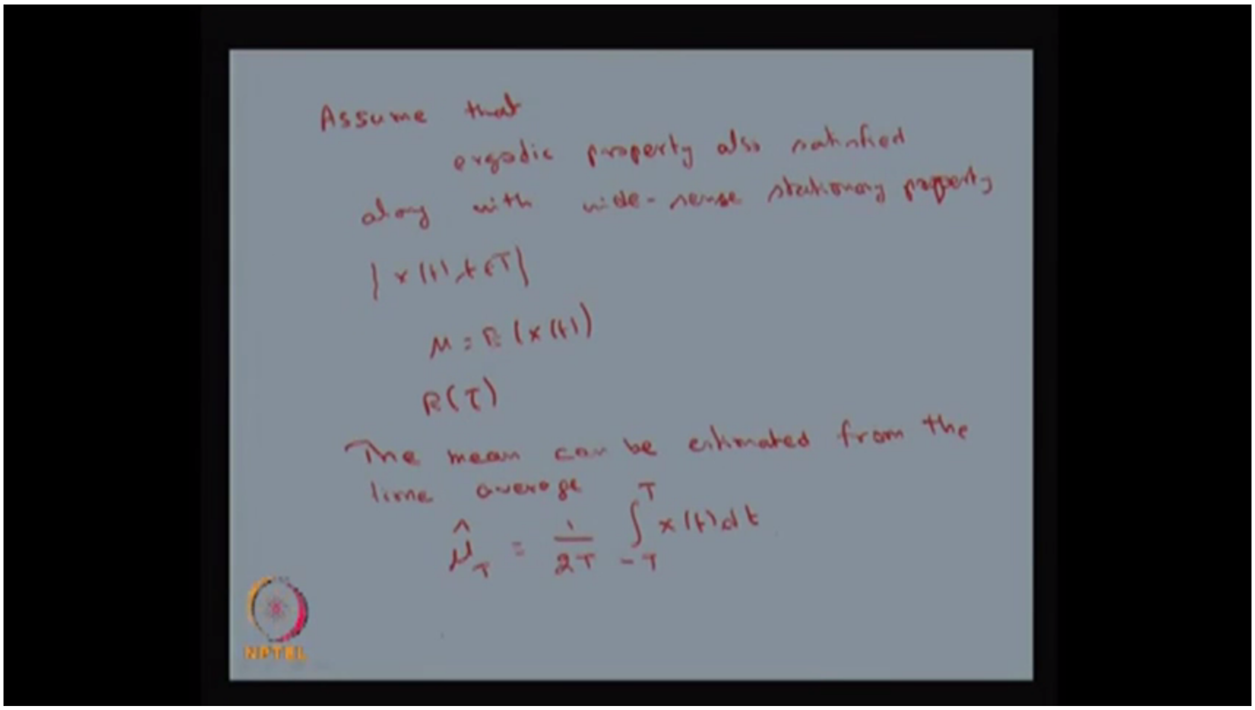
We will go for the third example. In this third example let me start with the stochastic process, here this each random variables are uncorrelated random variables with the mean of each random variable is going to be some constant k which may be assume to be 0 in some situation. So in general you keep the mean of each random variable is going to be some constant k and you make X of m X of n that is going to be its variance for m is equal to n and for all other quantity you make it 0. Not only this each random variables are uncorrelated random variable that means if you find out the correlation coefficient that is going to be 0 and the mean is going to be constant and expectation of the product of any two random variables if they are different it is 0 and obviously if they are same since you make the assumption therefore this is going to be a variance Sigma square. If you cross check all the properties of all the conditions of the wide-sense stationarity property starting with the mean function and second order moment exists that is finite and covariance function of any two random variables is going to be a function of only the difference. There all those three conditions are going to be satisfied therefore you can come to the conclusion, I am not working out here. This is going to be a weakly stationary process or wide-sense stationary process or it is going to be call it as a covariance stationary process also. And This stochastic process is also called a white noise process. This is very important in the signal processing. You keep the uncorrelated random variable with this assumption the mean is going to be a constant which may be 0 and the product of expectation is going to be these values and this is going to be a weakly stationary process in the sense it satisfies all three conditions of that weak sense or white sense stationary process and this stochastic process is called a white noise process.

Note that this stochastic process we didn't make the distribution of each random variable Xn what's the distribution of Xn is not defined here; without that we give the all the assumptions of the mean and variance therefore this is going to be very useful in the time series analysis as well as the signal processing and this particular stochastic process is called the white noise and sometimes we make the assumption the Xns are going to be normally distributed random variable also but in general we want to define – we want to give what is the assumption what is the distribution of Xn without that this stochastic process is going to be call it as a white noise process.



Addition to the white sense stationary process one can assume that Ergodic property also satisfied along with white sense stationary property.

For illustration purpose we have discussed Bernoulli process. That means the given stochastic process is a wide sense stationary process as well as it is the Ergodic property is also satisfied in that case the mean function is going to be a sum independent of t that you can make it as the mu and auto covariance function is going to be a R of tau only because it is a wide sense stationary process therefore the mean is independent of t and the auto correlation function is going to be a function with the only tau and we have Ergodic property therefore you can find the mean can be estimated from the time average. So this is possible only if the Ergodic property satisfied so the mean can be estimated with the up arrow that means the estimator estimation of a mean that is same as 1divided by 2 times t and minus t 2T of X of t dt. So this is possible as long as the stochastic process is – so in general I define t belonging to T that T is different from this T so here you have the time interval of length 2T within that 2T if you find out the time average and that time average quantity is going to be the estimation for the mean that means if mu t converges in the squared mean to mu as a t tends to infinity then the process is going to be a mean Ergodic stochastic process is going to be call it as a mean Ergodic process. Similarly one can estimate other higher order moments also provided the process is Ergodic with respect to those moments. So here I have made the Ergodic with respect to the mean therefore you are estimating the mean with the Ergodic property. Similarly if this given stochastic process is satisfying the Ergodic property with the higher order moment then those measures also can be estimated in the same thing. So here the mu t converges in squared mean to mu as t tends to infinity. So that is the conclusion we are getting from the Ergodic property along with the wide sense stationary property.



With this let me stop today's lecture and some more examples for the stationary process. So maybe those example maybe a white sense stationary process or strict sense stationary process that I am going to give in the next lecture. So today's lecture what I have covered is what is a stationary process and to conclude or for a given stochastic process is going to be a stationary process for that we have given few some definitions. So with those definitions we can come to the conclusion the given stochastic process is going to be a wide sense stationary process or strict sense stationary process and I have given three examples in today's lecture and I will give two more examples of a stationary process in the next lecture.

Then I will go for some simple stationary process that is auto regressive process and moving average process and some more stochastic process for the stationary process example I will give it in the lecture 2.

With this today's lecture is over. Thanks.