Networks and systems
Prof. V.G.K. Murti
Department of Electrical Engineering
Indian Institute of Technology – Madras

Lecture-9
Basic Discrete Time Signals

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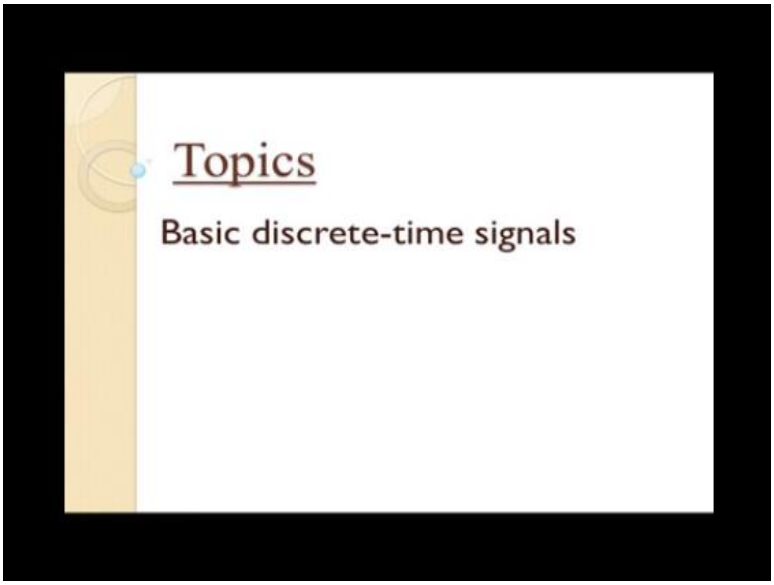

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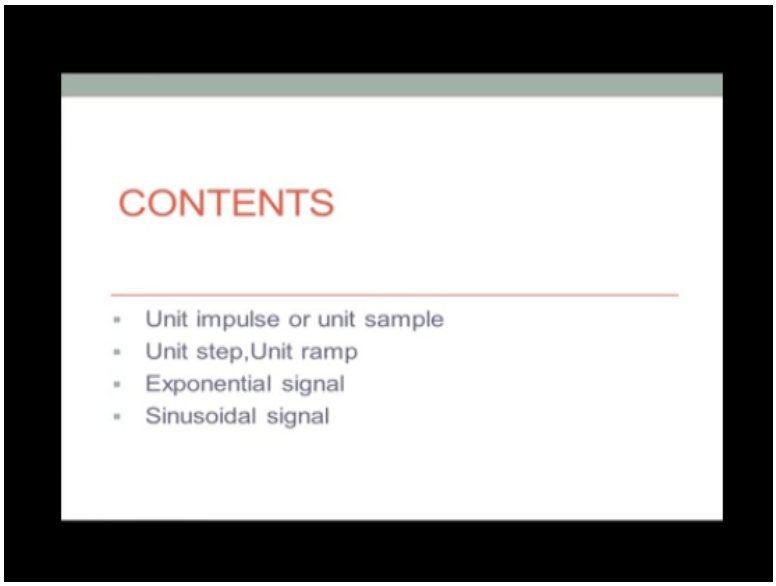

We will now have a look at the standard signals discrete time signals which will make use of in considering the performance of discrete time systems. Now, let us look at the basic discrete time signals.

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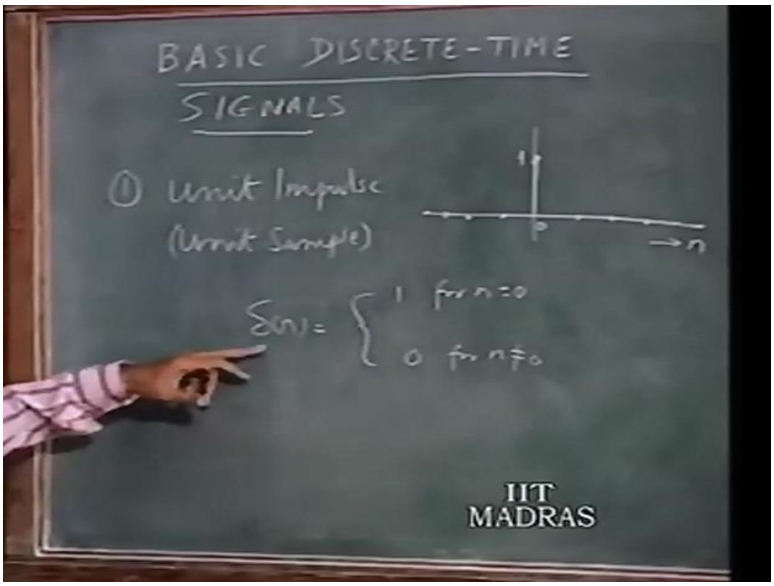

The first signal we will talk about the unit impulse this is also called unit signal or unit sample. Basically, so it is 0 everywhere except when n equals to 0. So, this is called delta n that is the symbol that is the use for this equal to 1 for n equal 0 equal 0 for n 0 equal to 0. So this is just a single sample occurring n equal to 0. This is called a unit impulse simply called a unit sample or a unit signal.

It is the term impulse is used borrowing the terminology from the continuous time signals, it does not mean the value of this at n equal 0 is infinite its finite it is equal to 1. So, impulse perhaps is a kind of misnomer but still we will call it a unit impulse because it corresponds to what we have a unit impulse in the continuous system. It is symbolized a delta m 1 for n equal 0 0 n for not equal 0.

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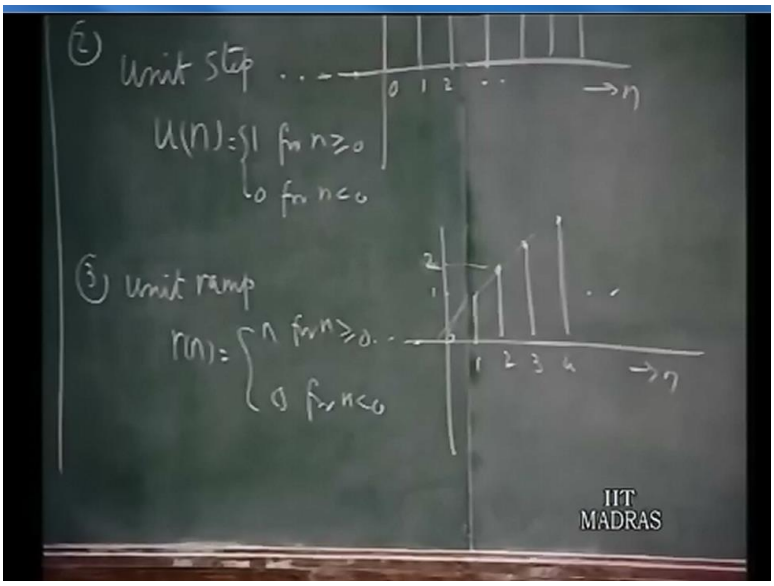

Now, just like the unit steps we also here are the continuous case we have also a unit step symbolized as u n. Now, here the value of the discrete time signal is 1 by through for all non negative n 0, 1, 2 etc and 0 for negative values of here like that. So, u n can be written as 1 for n greater than or equal to 0, 0 for n less than 0. So, in contrast to the continuous time case here at n equal to 0 we have a definite value which is equal to 1.

In the case of a continuous time case at t equal 0 as a unit step is concerned we can take it as 0 or 1 or half whatever it is, it can be left ambiguous, but as for as a unit step in a discrete time case is concerned the value is definite and equal to 1. So, this value is equal to 1 here also this is equal to 1. Now, similarly you can have a unit ramp, it is symbolized rn equals n for n greater than or equal to 0, 0 for negative values of n.

So, that would be 0 everywhere that here it will be 0 like this 1, 2, 3, 4 etc up to n. At 1 is equal to 1, at 2 is equal to 2 and so on and so forth. So, that is what is called a unit ramp which is somewhat similar to what we have in the case of continuous time system except in the continuous time as a function of t its take of like this but here the values of the samples increase in preposition to m.

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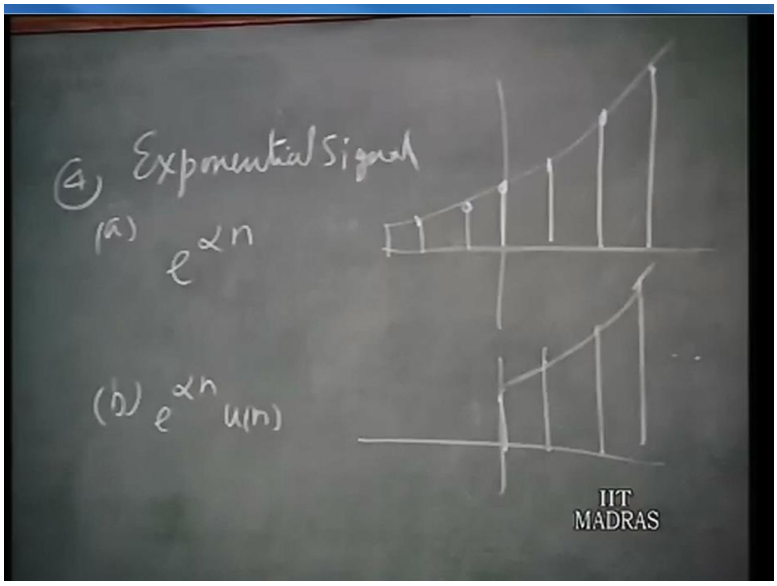

We can also have an exponential signal e power of alpha n so it is have something like exponential increasing like this e to the power alpha n. Now, on the other hand if I have e to the power of alpha n times u of n that means this is multiplied by a unit step that means all the samples are cut off and you are having only this portion. That is obvious, we multiply e to the power of alpha n by u n that means the negative samples for negative values of n or just removed there will be equal to 0 of course.

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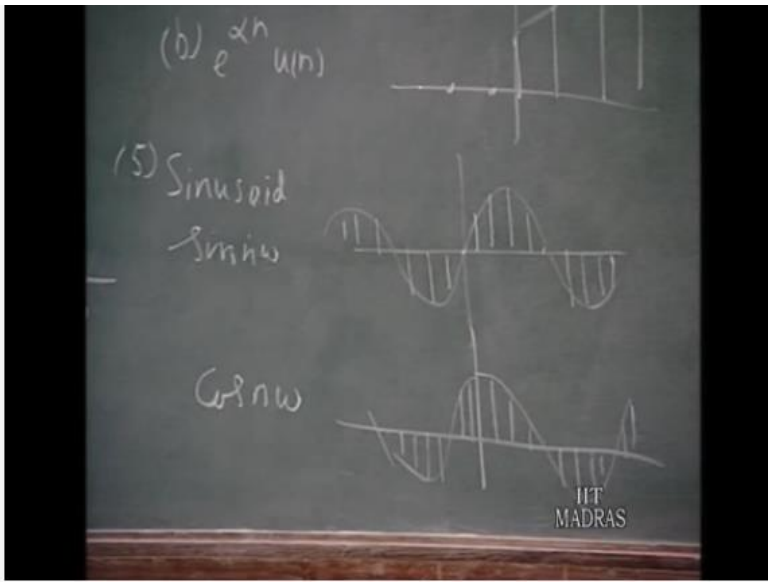

Similarly, you can have a sinusoid you can have sin omega n omega n or n omega which will be in general case this is the envelop the samples will be like this all the samples will fall an

envelop which is a sin wave. Similarly, if we have cos n omega it will be a similar situation but this will be now a cosine curve.

So, the samples will be again discrete by there the tips of all samples will follow a sin wave or a cosine wave as the case may be, sin n omega or omega n right may be better call it n omega sin n omega and cos n omega or sinusoidal signals. Again, if you take sin n omega multiply by u of n this portion will be cut off, cos n omega multiply by u of n this portion will be cut off.

Now, these are the basic type of discrete time signals that we would like to use from this we can build up other signals for example e to the power alpha n sin n omega the type of signals multiplication of these two all those thing can be produced.