Structural Reliability
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Lecture –145
System Reliability - Time Defined (Part - 01)

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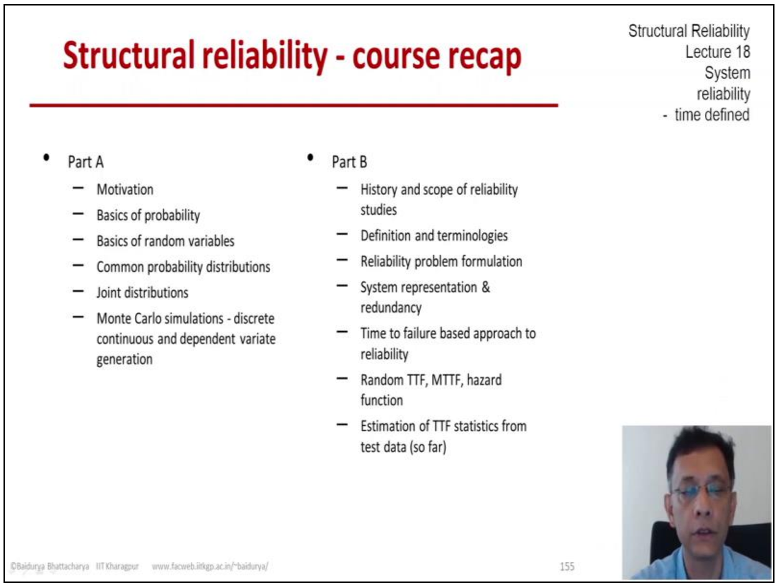

Today we have the last lecture of our part b of the course. So, let us recap how far we have come and what we are going to do today. So, part A had to do with the basics of the course we discussed why we are taking up this subject discuss the basics of probability the basics of random variables distributions. We discussed quite a few common discrete and continuous probability distributions that appear in reliability and structural reliability in particular.

Joint distributions and we looked at multi color simulations in particular discrete and continuous and dependent random variate generation in this part which is part B. We introduced the development of the subject from its early days defined relevant terms spent a good amount of time discussing how to formulate reliability problems especially the kind that we are interested in the capacity demand type and then how to represent systems in terms of its constituent elements.

We discussed types of redundancy and how redundancy can be limited because of dependence and common cause and such then we started tackling time to failure based approach to reliability we spent a good amount of time discussing the various functions related to the random time to failure the distribution function the density function the hazard function the reliability function the mean time to failure mean residual life and so on.

Then in the previous class we had a good discussion on how to estimate from tests from reliability tests whether censored or otherwise all these metrics mean time to failure rate reliability function hazard function and so on. So, today we are going to look at time dependent system reliability. So, let us see what we have in plan for today.

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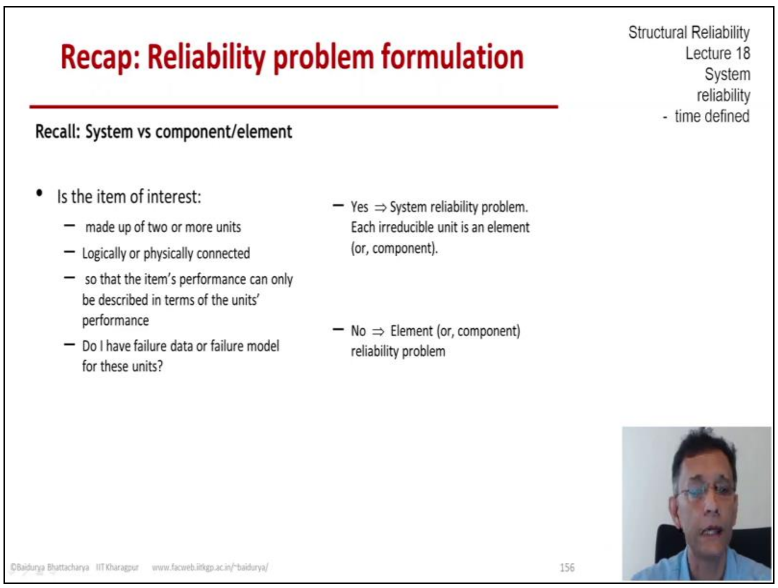

So, let us let us recap where this time dependent issue comes from and where this where the system versus component division comes from. So, we did discuss this. So, let us recap the question is this is the item of interest what we want to find reliability for is it made up of two or more units that are logically or physically connected such that and this is the key point this item's performance can only be described in terms of the units performance.

And then do I have this is a practical interest do I have failure data or failure model for these units. So if the answer is yes I have a system reliability problem and each such unit that cannot be reduced any further is a is an element or a component and if the answer is no then I have an element reliability problem. So, today we are going to look at system reliability problem and now let us just recap this physics based versus phenomenological issue.

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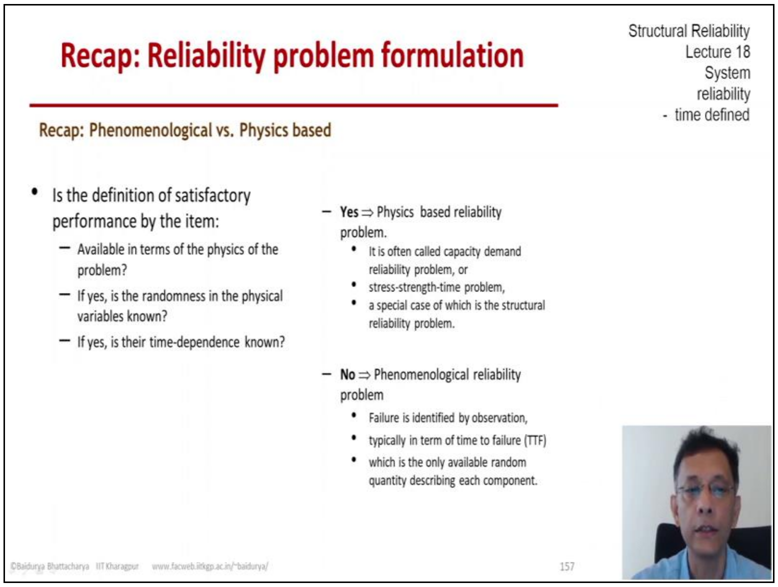

So, the question is the definition of satisfactory performance for the item is it available only in terms of the physics of the problem the underlying physics in our case in most cases mechanics and if it is yes then do I know the randomness is involved in all the variables of interest and if yes do I know their time dependence if the answer is yes to all these questions. So, what I have is a physics based related problem and often known as capacity demand strength stress strength time and so, on.

If the answer is no which is what we are looking at today failure is identified by observation and typically in terms of time to failure which is the only random information that we have for each component and the system is built up logically involving these time to failure for each component. So, that is what we are going to look at today.

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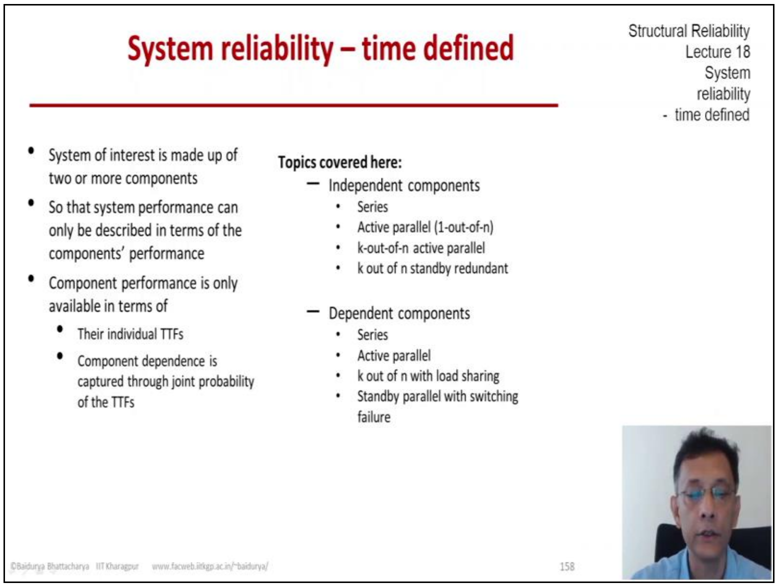

So, to recap our system is made up of two or more components and the system can be described only in terms of these components i have information of component performance in terms of the individual times to failure and if there is dependence it's captured through the joint distribution of these times to failure. So, this is what we plan to do today in terms of topics. So, um under independent components we are going to look at the series system the active parallel which is one out of n system.

The generalization k out of n system and then we are going to look at standby systems also and when there are dependent components we are going to look at series active parallel k out of n with load sharing standby with switching failure. So, that is our plan.