Structural Reliability
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Lecture –238
Target Reliabilities (Part - 01)

Target reliability levels with this we to the last major topic of this course. So let us look back and see how far we have come and what we learned along the way.

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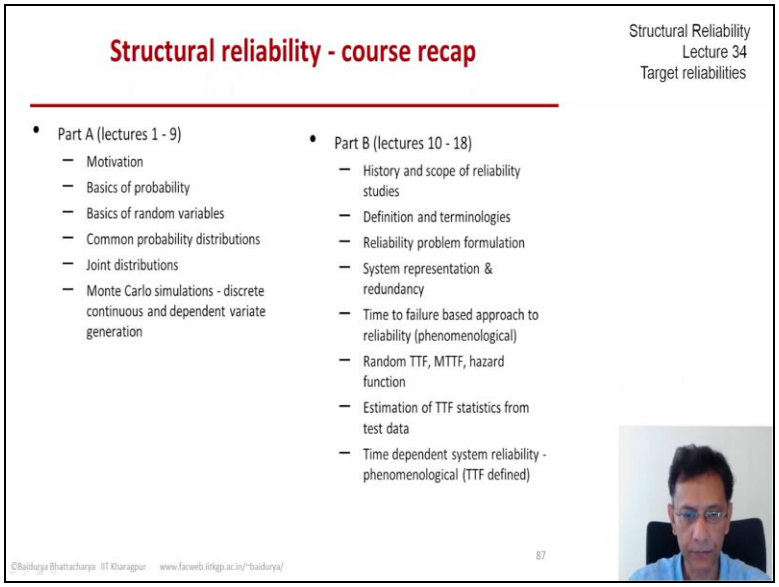

We started with part A which was lectures 1 through 9 and ah we started with what this course expects to cover. Then we move on to the basics of probability theory the basics of random variables and distributions. We discussed quite a few discrete and continuous random variables that occur commonly in structural liability theory. We talked about joint distributions and we ended part a with Monte Carlo simulations particularly the generation of discrete continues and dependant random variables.

Part B which was lectures 10 through 18 we gave an overview of the history and how the subject of reliability came to be we defined the basic terms we spent a good amount of time in how to formulate reliability problems. And then discussed how systems can be represented in terms of its constituent elements and what different types of redundancy out there are for a system. Then

we spent a series of lectures on the time to failure which we call the phenomenological approach reliability because that was the only random quantity the TTF in defining the performance of the item in question.

So we ah discussed the reliability function the hazard function various metrics like mean time to failure mean residual life and so on. We also discussed estimation of TTF statistics from test data and then how a system time to failure may be described in terms of the element times to failure.

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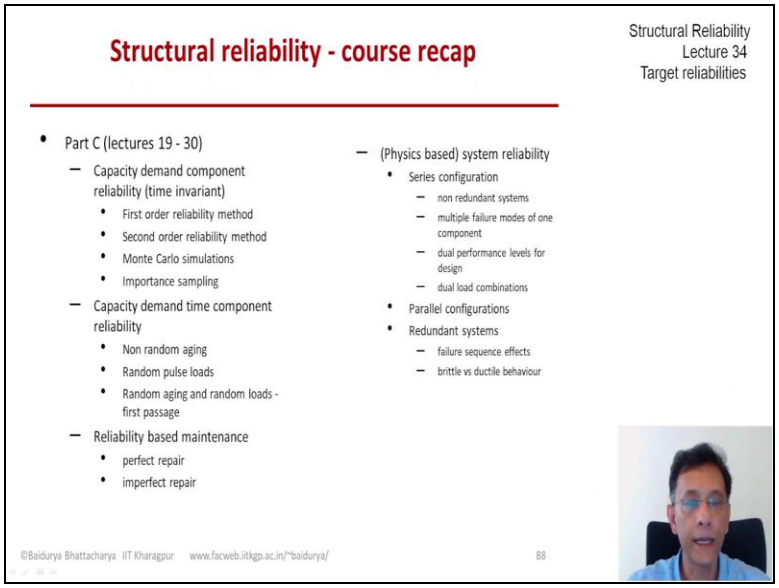

In part C which was the longest part lectures 19 through 30 we move to physics based a description of a reliability of failure and we started with component formulation component reliability from the capacity demand point of view. In that context we learned the first ordered label into method for computing failure probability, the second order reliability method and then multicolor simulation based techniques including the very introducing important sample approach. Then we brought in the time aspect and we first looked at components that age or loads that changed with time but in a non random manner.

And then we introduced first randomness in the loads as a pulse process with identical distributed load magnitudes and then pulses that occur randomly in time according to a Poisson process and then we allowed both the strength and the load to very randomly in time and under certain assumptions we looked at that first passage problem. We then look at time dependent

liability because how it is affect by the perfect repair and imperfect repair.

We ended a part C with a system reliability discussion and obviously physics based capacity demand type. So, we looked at first the series configuration which was appropriate for non redundant systems on multiple failure modes for one component dual or multiple performance levels for one component or dual or multiple load combinations for the same structure. We then looked at parallel and other redundant configurations in which we looked at two extreme cases or two ideal cases one the brittle failure of elements and the other was the ductile failure of elements.

And because of the load sharing nature we also discussed the effect of failure sequences. So, that ah was the end of part C.

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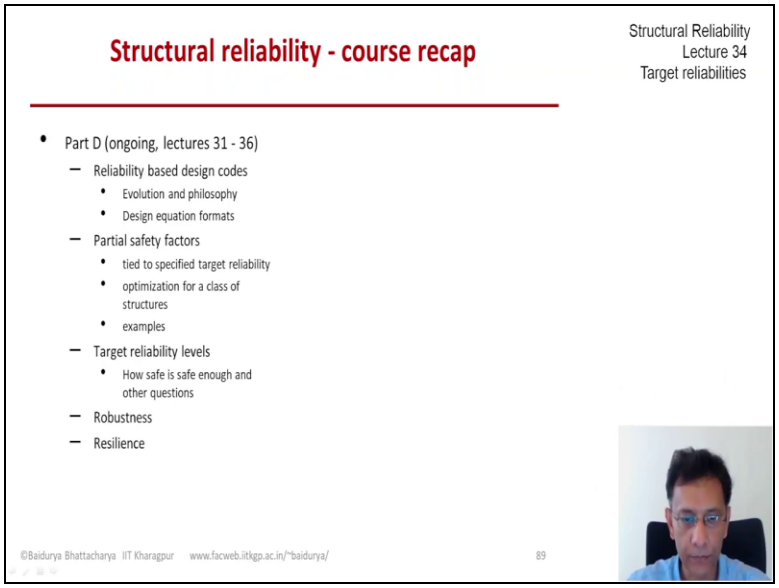

And what is going on with our part D have 6 lectures and today is lecture number 34 what we have already recovered in the first two lectures of party are reliability based design codes their evolution the philosophy behind them and the format of design equations that involve more than one factors of safety the partial factors and then we showed clearly how the partial safety factors or even one safety factor can be tied to a specified target liability.

And then and we showed for a class of structures which is very useful for design how a set of

partial factors can be optimized and then worked through a few examples. What we are going to start today is target liability levels how to set them and obviously a very important question is how safe is safe enough when you're talking about life safety type limit states and then we will this week with a few more concepts that have come up during our discussion ah those of robustness and that of resilience. So that is the plan for this week so let us start.