Structural Reliability
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Lecture –01
Introduction (Part - 01)

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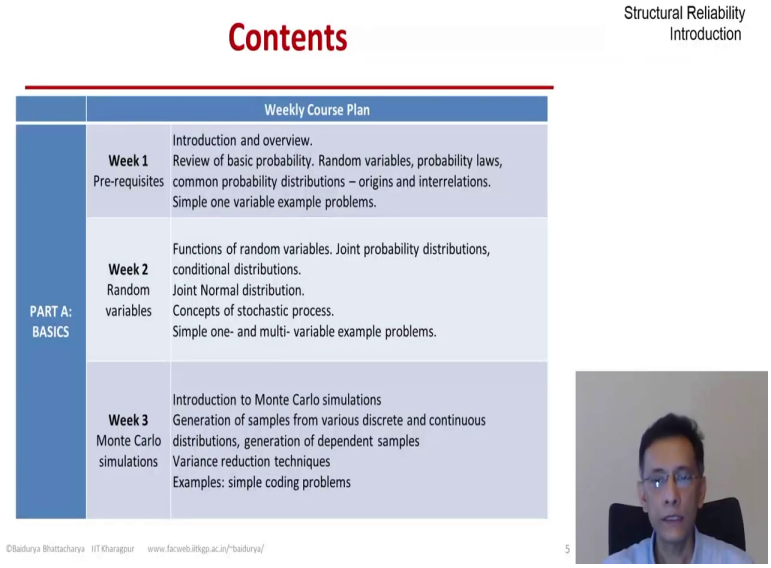

Now let us look at the content of our course this will be a 12-week plan and I have split this course into four parts. Part A deals with the basics the first week will be an introduction and overview of some of the prerequisite items like a review of basic probability, random variables probability laws. The second week would be a little more advanced topics we will look at functions of random variables, joint distributions with emphasis on the joint normal distribution.

And some introduction to the concept of stochastic process because we are going to look at time dependent reliability during the course and while doing that we will solve simple problems, in the third week we will introduce Monte Carlo simulations which will be very helpful in solving many problems that cannot be solved in enclosed form. So, we will discuss generation of samples from various discrete and continuous distributions using pseudorandom number generators, generation of dependent variants which have a lot of practical utility.

We will discuss variance reduction techniques also because basic Monte Carlo simulation can be rather inefficient and we will practice some coding problems as well.

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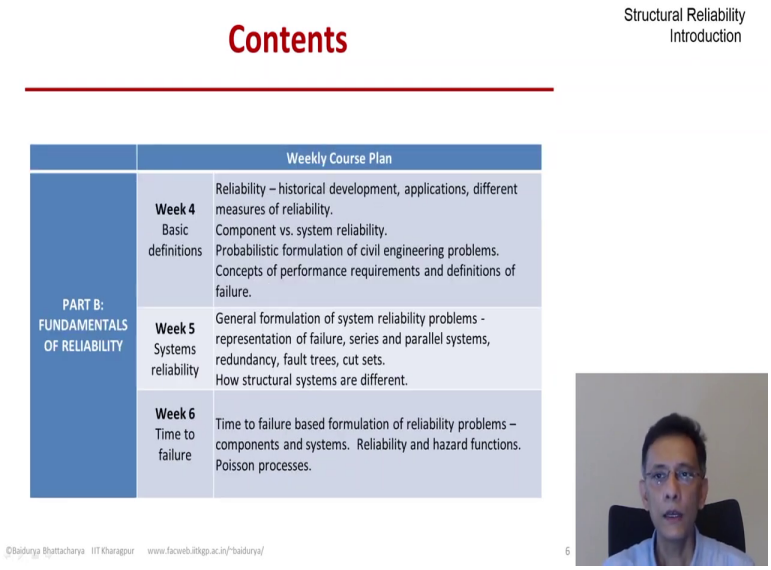

Part B will be the introduction of fundamental concepts of the subject of reliability. It is not a very old discipline it is about 70 years old. So, it came into its own during the and after the Second World War. So, we will discuss briefly the historical development and the growth of the subject while discussing that we will talk about how the civil engineering problems in reliability came up and got defined with and especially with regard to structures.

And then how structured reliability grew as a discipline. In week 5 we will look at systems how systems are modeled as a logical arrangement of components and how the system and how system failure is expressed in terms of component failures. And while doing that we will also point out how structural systems have some features that make them a bit different and sometimes difficult to solve.

Week six will be at the end of Part B we will end it with a time to failure based approach to reliability.

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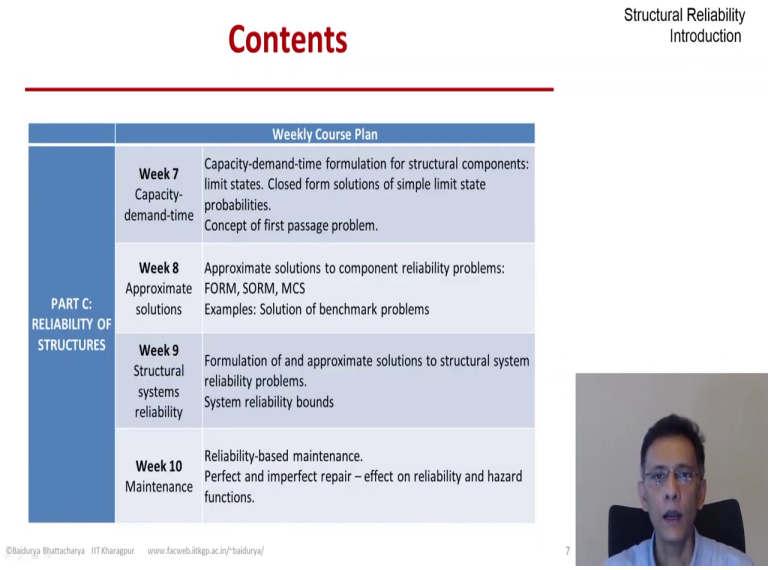

Part C will delve deeply into structural reliability we will introduce the capacity demand time formulation which is common for structural systems and touch on the first passage concept. We will discuss at length the concept of limit states try to solve some problems in closed form and those that cannot be solved in closed form which is most problems. In week 8 we will discuss approximate solutions the very elegant FORM First Order Reliability Method and its extension to SORM Second Order Reliability Method and then Monte Carlo simulations.

In week 9 we will look at structural systems reliability and we will end Part C with reliability based maintenance.

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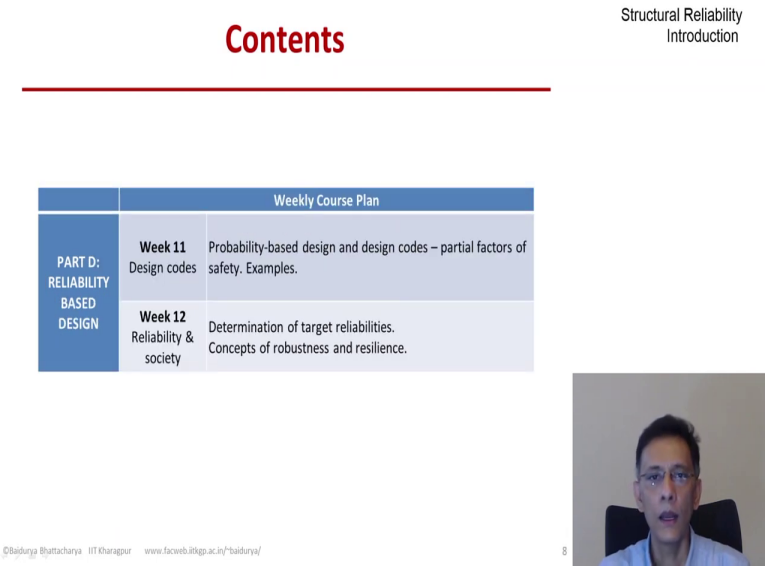

In Part D we will first look at how probability based design codes are developed and in the last week we will venture into the interface of structural reliability and society. Try to answer the question how safe is safe enough and concepts that are becoming more and more relevant are those of robustness and resilience.

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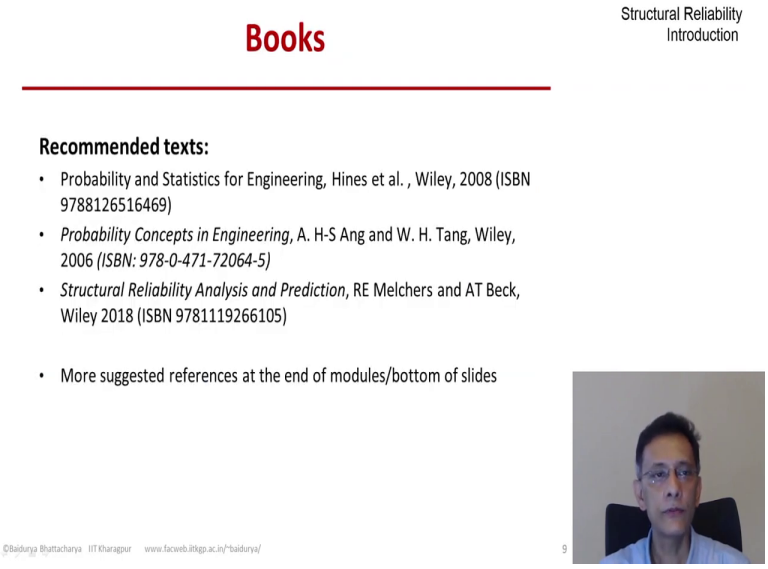

In terms of textbooks and recommended books that I have listed 3 here the book by Heinz et al is a very nice Basic Prop Stats book for engineers. The book by Ang and Tang probability concepts in engineering that is an excellent book and as is Structural Liability Analysis and Prediction by

Malchest and Beck but there will be obviously more books more suggested references that I will list at the end of modules or at the bottom of slides including articles and papers.

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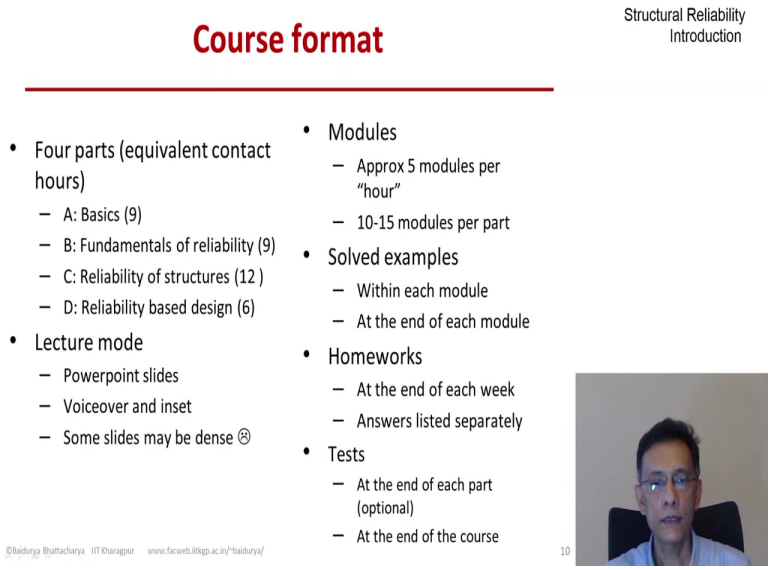

The course format is as I said there will be 4 parts in terms of equivalent contact hours Part A will have 9, Part B which is fundamentals of reliability we will have another 9 and then Part C which is reliability of structures that would have 12 equivalent contact hours and then Part D which is reliability based design would have another 6. The lecture mode will be like this Power Point slides with a voiceover and an inset picture and on the top right.

You will see which week we are covering and what the main subject of that is. So, it will help you locate the lectures. Some slides this course is a parts of it are quite mathematical in nature. So, some slides will be a bit dense and I am sorry about that but please pause the lecture and take notes if you would like for those slides. There will be modules um roughly about 5e per hour of lecture and each of these parts would be something like 10 or 15 or a few more modules in these parts.

They will be solved examples I will put a lot of emphasis on that during each module and at the end of each module I will also try to work through some examples. There will be homeworks at the end of each week and answers should be listed separately and tests there will be optional tests

the end of each part and a required test at the end of the course.