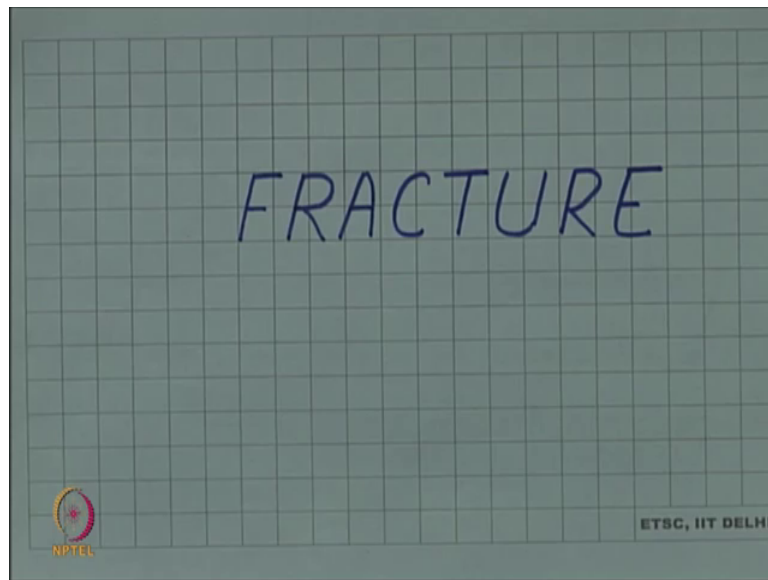


Introduction to Materials Science and Engineering
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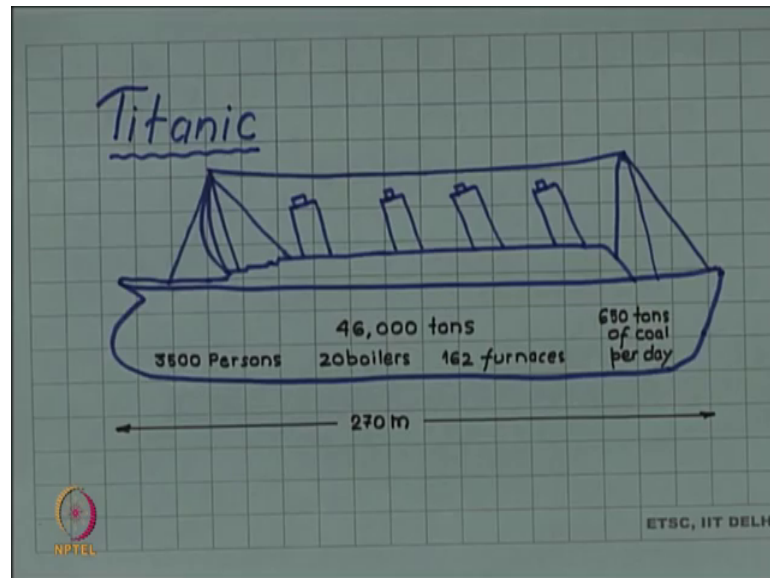
Lecture - 137
Fracture

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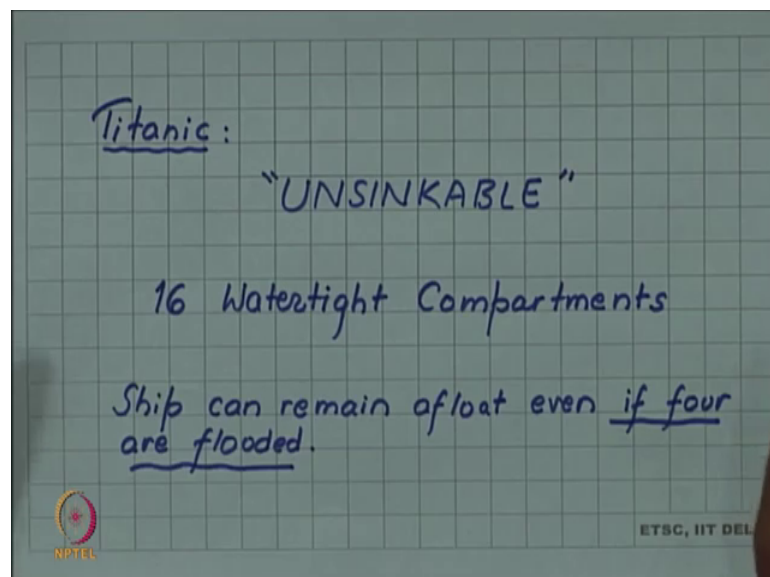
Let us now come to a new topic of fracture. This will be the last topic or last chapter of our course.

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let us look at a historic failure story and that of titanic, we all know about titanic, it was one of the largest ship when it was built its weight was 46,000 tons, it was supposed to carry 30,500 persons to run the ship, there were 20 boilers, 162 furnaces and it was consuming 630 tons of coal per day the entire length of the ship was 270 meters. So, it was a huge ship.

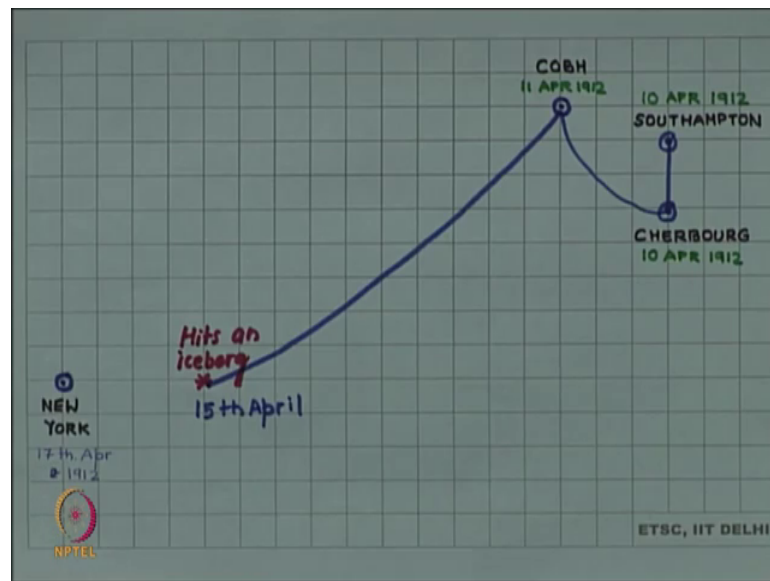
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And it was named unsinkable or it was called unsinkable because of a special design which had 16 watertight compartments in its hull and the design was such that even if 4 of these compartments are flooded, the ship will not sink.

So, the in the compartments are watertight such that if one compartment is flooding the water will not leak into the other compartment and 4 of these compartment if simultaneously will get flooded still the ship will be floating.

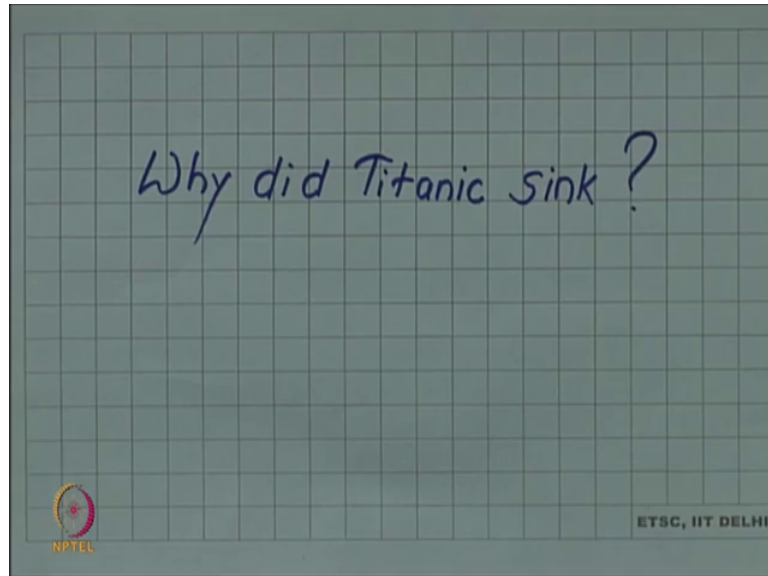
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But you know this story it started its first journey on 10th April, 1912 from Southampton port and then on the same day reached across the English channel and reached Cherbourg from there, it went to Ireland Cobh and on a 18th April, it is started its long transatlantic journey to New York and it was supposed to reach New York in a week's time on 17th April; however, pantry on 15th April morning actually it was night.

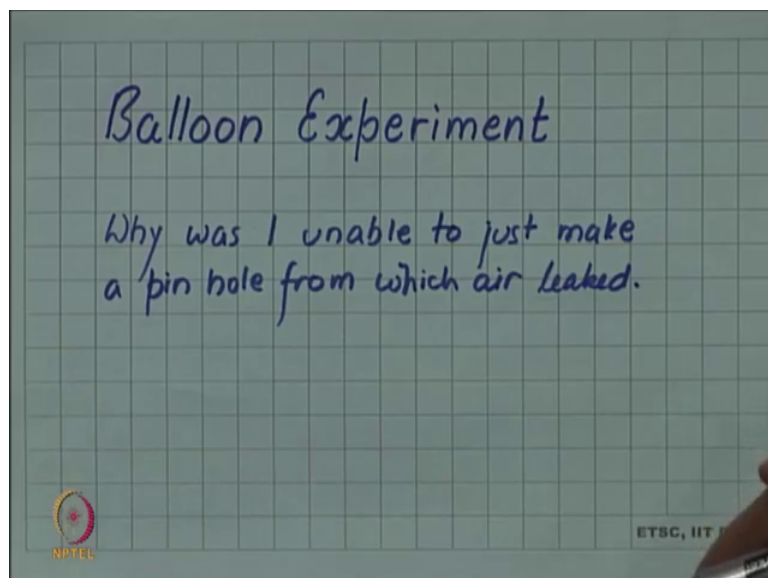
So, very early hours of 15th April, the ship hit an iceberg and it sank.

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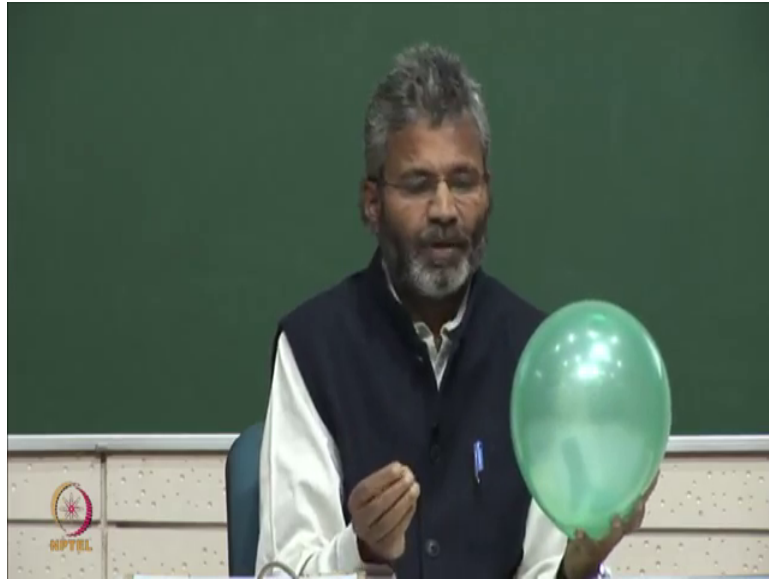
So, it is a very tragic story with a lot of loss of property and life as we know; the question is why did titanic sink and why did it sink so easily? It was made up of a steel and it was hitting an iceberg which was made up of ice and if it steel hits ice as we do it whenever we are trying to break ice blocks, we use steel hammer. So, steel does not break the ice breaks, but in this case a much thicker hull made of much thicker steel hit an iceberg and it broke into 2.

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So, it is now, let us do an experiment the balloon experiment, we will experiment with this balloon a very simple experiment, which as a child all of you have done.

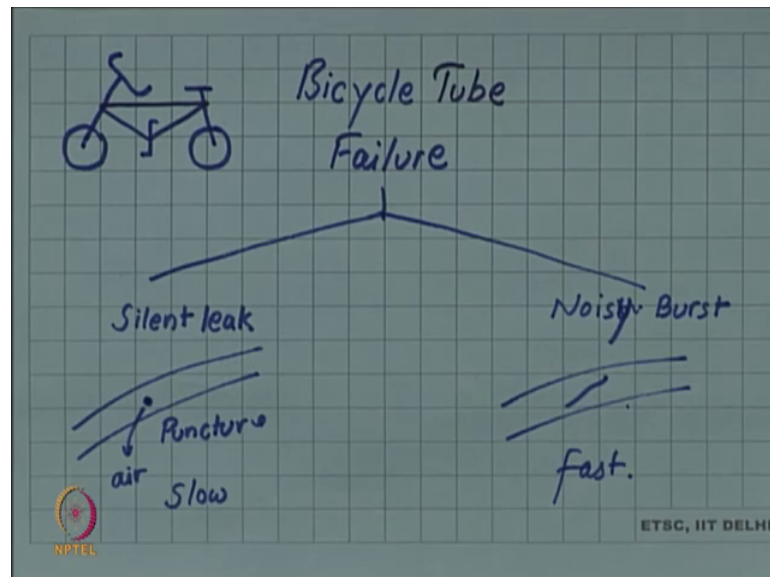
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So, I take this balloon and I take this pin and I try to puncture this balloon. So, you all know; what you expect; although you expected this result; this result actually should be unexpected because all I was trying to do; all I was trying to do was to make a hole equal in diameter to this pin; why was I not able to just make a pin hole in the balloon surface? Why did the entire balloon a tour?

So, from that point of view, this is a very surprising and interesting experiment that why was I unable to just make a pin hole from which air leaked? Instead I was trying to make a pin hole and the whole balloon burst. So, this is a very surprising result.

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Finally, let us look at more everyday experience of bicycle tube failure we all know do not those of us who use bicycle that the tube fail in two different ways one is silent leak; there is a hole in the tube, there is a hole in the tube and the air gradually comes out.

So, we call this a puncture; puncture air comes out of the tube gradually. So, it is a slow process and the hole or the puncture does not increase in size, it remains stable, but the other way of failure is a noisy burst which can be quite embarrassing. So, in which you will find that there is a rupture in the tube a long crack and it is quite sudden.

So, this is slow; this is fast why these two different way in both of both of the cases, failure is happening because air is coming out of the tube, but in one case air is coming out from a hole in a stable fashion in a slow manner in another case the air comes out rather rapidly, rather, suddenly and there is a large crack or a large tire in the tube surface. So, what is the difference between these two situations; what causes this difference this is what we will try to look at.