Architectural Acoustics
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Lecture – 25
Introduction to Auditorium Design Some Examples

So, now, we are on lecture 25, which is the last lecture of this module on Introduction to Auditorium Design. Here, after knowing all the concepts which has been discussed in the earlier 4 lectures. I will try to show you the applications in some very good halls, which are quite renowned and these are not made by individuals. Yes, the design architect is may be one, but acoustical experts have designed the interior. And, even then after making it a number of trials, number of changes, are still being done in some of the halls.

So, you will see how really the principles have been applied? And, yes whether they have made a good impact or bad impact you can see it by yourself or understand. And, fortunately many of you maybe fortunately visiting all these halls in later part of your life and yes that time you may remember or recall this particular course.

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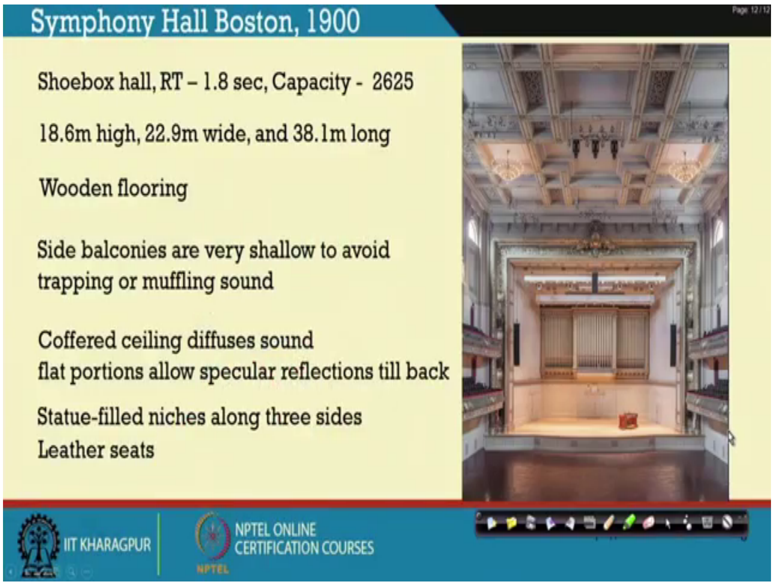

So, this is the famous Symphony Hall Boston, which was by which was the interior was done by clement Sabine. So, this was in, 1900. And, here you barely see lot of details, this was a shoebox hall and the reverberation time achieved was target it was 1.8, seconds capacity is 2625 and height width length all are written over there. The flooring was is all of wood. And the balconies were not actually the way we had planned or shown. So, that has come up with time. You can see the balconies here on the here on the sides, you can see the balconies here.

So, these were very narrow balconies on the side to avoid any kind of trapping of sound or muffling or sound so, of sound. So, sound cannot get trapped inside it keeping that in mind, those were made very small projections at the sides, you can see a reach coffered ceiling on top. So, it was spanning this 29.22.9 meters that is around 23 meters. And; obviously, the single beams would have been very heavy. So, these coffered slab, coffered beams were planned.

In which the side of the or the edges of the beam allowed in diffusing sound and the flat slab areas actually helped in the slab areas; actually helped in reflected sound. So, these particular segmented areas helped in reflecting sound into the audience. And, these projected soft beams all helped in diffusing sound into the hall. There were lots of statues at different positions, you can see one very faint over here. So, there were statues filled niches which also helped in diffused sound into the hall.

So, these are studied, these were made, and these were checked, the seats were all made of had leather upholsteries. So, these were all experimented and put in and it achieved the RT of 1.8. And, this is one of the famous halls which was designed by acoustically designed by Clement Sabine.

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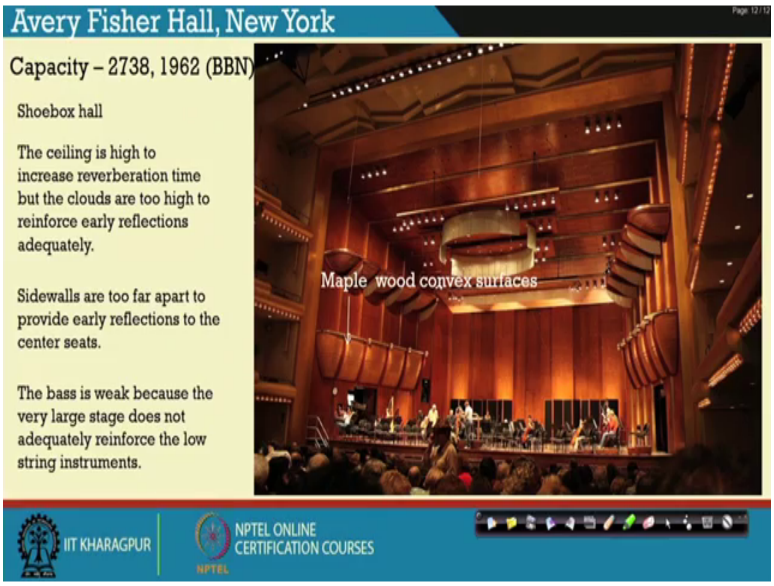

We come to the next hall the Avery Fisher Hall which has a capacity of 2738 and made in 1962. Where you see here at the ends, you see a lot of convex surfaces. These are all wooden surfaces to reflect sound these are maple wood convex surfaces, but these were not initially there. These are all additions to help sound to be reflected towards the people, because the hall was not receiving lot of much of first reflections from the sidewalls. This is also a shoebox shape, but the sidewalls were far away. So, the central part or the central part of the seating was not getting reflected sound from the walls. And, the central audience were devoid of sound.

Same thing happened from the ceiling site the reflected path from the ceiling were too long. So, these clouds these shaped surfaces on the ceiling were too high to reinforce the basic the source sound and help in early reflections adequately.

So, lot of things where with time were added of which this maple wood convex surfaces were one. And, in this hall because there was no other shape than straight flat things the bass was weak that is the low frequency was lost. In that case it did not could not achieve better sound quality for the that is the warmth was lacking in this particular hall, but yes later lot of changes have been made and a lot of improvement has been done to achieve a better quality.

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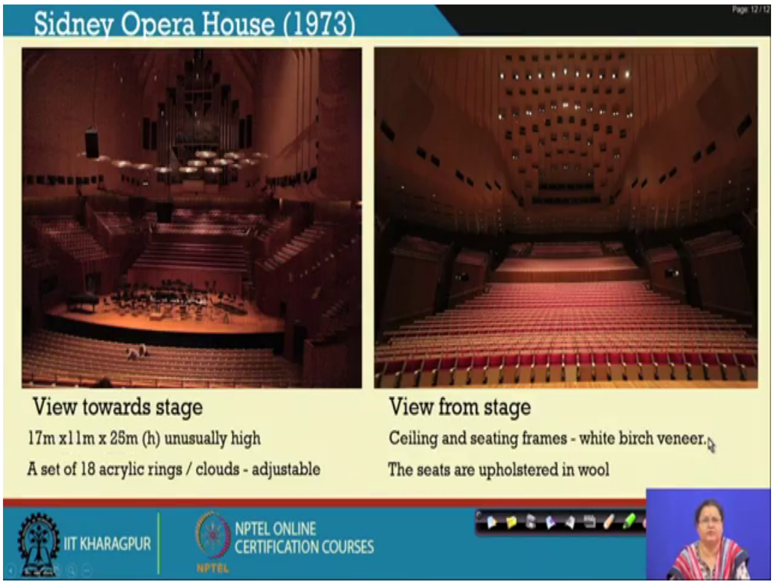

We moved to the next hall, which you all know, Sidney Opera House by John Anderson, it has multiple number of halls, it has a more than the apart from this there are many other halls in this, but this hall is of particular importance. This site is a world evenness co world heritage site.

So, inside this, the sound was really criticized. The quality of sound inside this particular hall was really criticized, but a lot of improvement has been done and yes till date it is being upgraded for acoustical quality. Here you can see the view from the view towards the stage you can see on the top here there are the number of clouds, which are convex shape and allowing sound getting reflected back to the stage. So, that the players here can get the sound from the top and get an ensemble sound.

Here, if you observe it is a shell structure. You can see this sawtoothed profile, which helps in diffused sound inside the towards the audience. This is a view from the stage side towards the seating. These acrylic rings, have can be adjusted height wise to achieve a better sound quality or better ensemblement for the players over here, the orchestra players over here. And also to send the sound in the towards the audience.

These clouds acrylic clouds were later changed with say put with in fills rectangular reflectors were put in, various experiments were done height was adjusted. And, things are still being tried out and to get a to achieve a better sound quality. All the seats over here are upholstered in wool.

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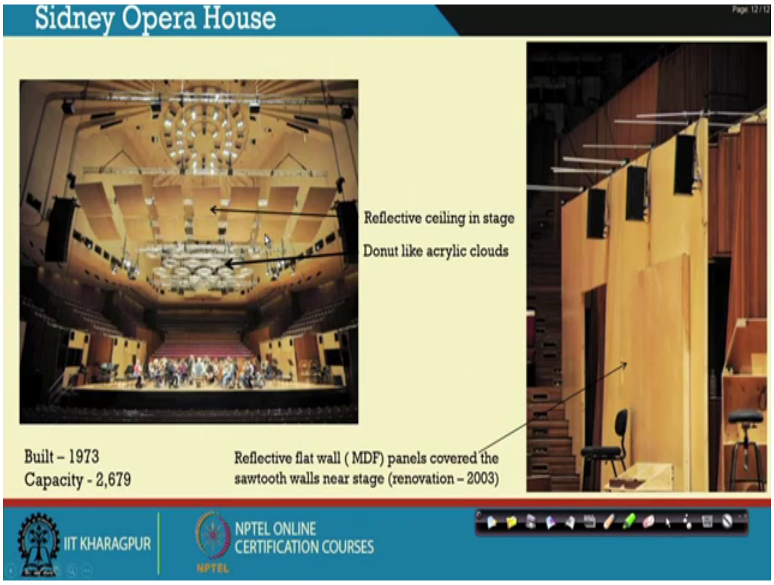

We see a further detailed improvised hall. These are taken from a paper which has been referred at the end, this is the acrylic cloud and these are the reflected ceilings on the stage, which has been added. You see here on the sides which is the detailed out here, you can see in the stage area a lot of reflectors has been added to strengthen the first reflection. So, you can see MDF reflective boards which was a which was a very cheap solution to cover up the sawtooth facade in nearby the stage and the front of the hall.

So, these reflectors were added to improve the acoustical quality inside this hall. So, a lot of studies has been done you can go through the internet and you can actually download papers, if you are if it is possible. Otherwise to know this much is enough to see that within this hall even the first reflections for first reflections these MDF boards have been added as an addition as a later stage of time. The capacity of this you can see here the capacity of this hall is 2679.

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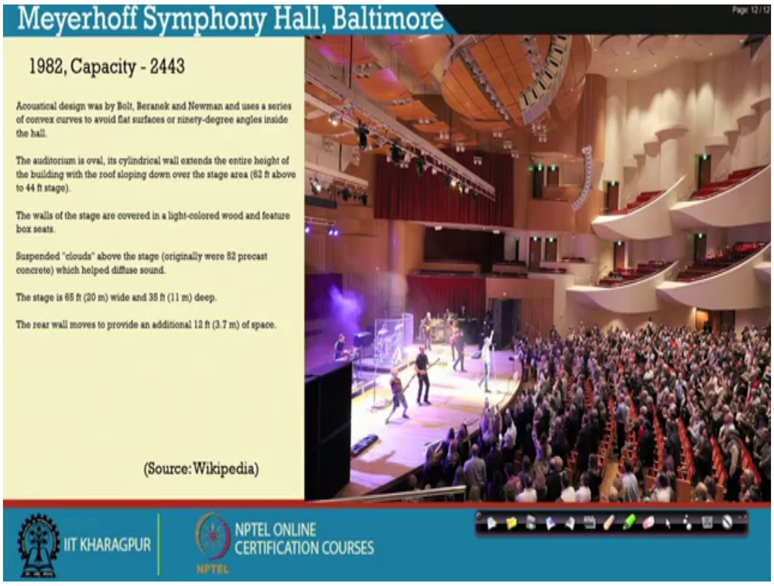

Coming to that next hall the Meyerhoff Symphony Hall Boston, here what you seen those hanging balconies not hanging, these are segmented balconies. Where sound could flow through these gaps. So, it is some are at a insight some are setting some are projected out. So, sound could move in a different way, which the architect has tried to achieve. You can see the convex wall surface here. So, this has been segmented and it is a wavy kind of pattern, which is allowing sound to be reflected in a or diffused inside the entire hall.

And, you can see the stage here there is no surround seating. So, this is the audience over here and this is the stage the performers working and you can see the reflectors placed over here. So, that these performers what this person is playing the person over here can the artists from here can listening what is going on there. So, this reflecting back of sound to each other, within the stage helps them to perform in totality in an integrated fashion which is very very important.

At the same time, these are also reflecting sound towards the audience. You can see the similar kind of profile, what we had seen in our Kalidas auditorium, when we had discussed the stage area and the stage area and the profiles. The capacity of this is 2443. So, these are all under very big at big sizes. This was made in 1982.

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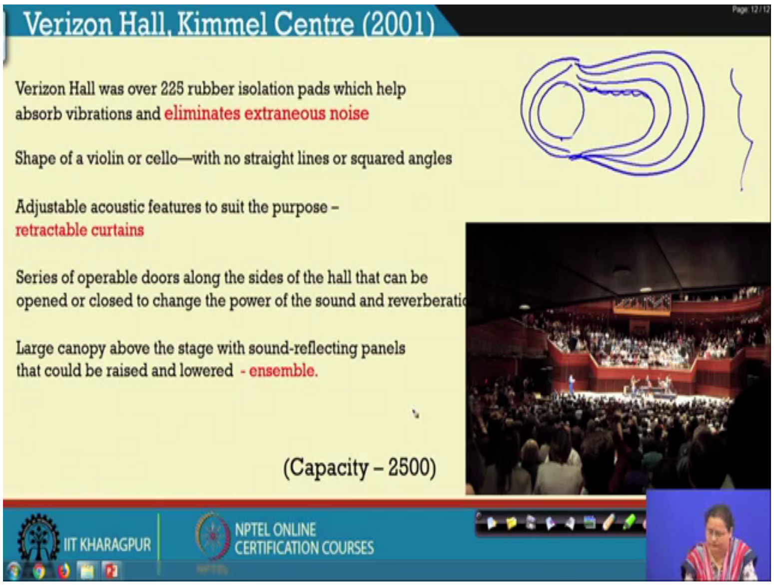

Now, coming to the Verizon hall in the Kimmel center, which is a which is of this century that is 2001. Now, to as I have not touched upon noise and vibration part, which will be taken I up by Professor Bhattacharya. Here I would like to mention that the entire hall was set over 225 rubber isolation pads to cut down, the vibration or the extraneous noise from the Broadway street just beside it.

The shape of this particular hall is like a violin or a cello. And, if you see the balconies are all around it has 3 tiers of balcony. And, the stage is here and some sittings around you as you can see in this picture.

So, all these surfaces you can see here are wavy. So, they are formed with such wavy surfaces as you can see this is the larger part of the audience, you can see pictures in the internet, but only this was the free picture available. So, you can see a lot of curvatures within which again these are having curved profile. So, these are all to diffuse sound into and this is the audience.

Now, this hall what did it have further? These had adjustable acoustical features like retractable curtains to control the RT, it had operable doors on the sides. So, that they could open some doors to allow some sound to go out and achieve different reverberation time. So, these kind of new innovations were really added in this particular hall with a capacity of 2500 to achieve a better acoustical quality.

Large canopy above the stage was placed as you have seen in the earlier. To get the, that could be raised or lowered depending on what kind of performance is happening, which is now tried out in Sidney opera house? Those acrylic donut kind of shapes clouds which wherein Sidney opera house and now being changed with this kind of adjustable reflector to create that ensemble quality.

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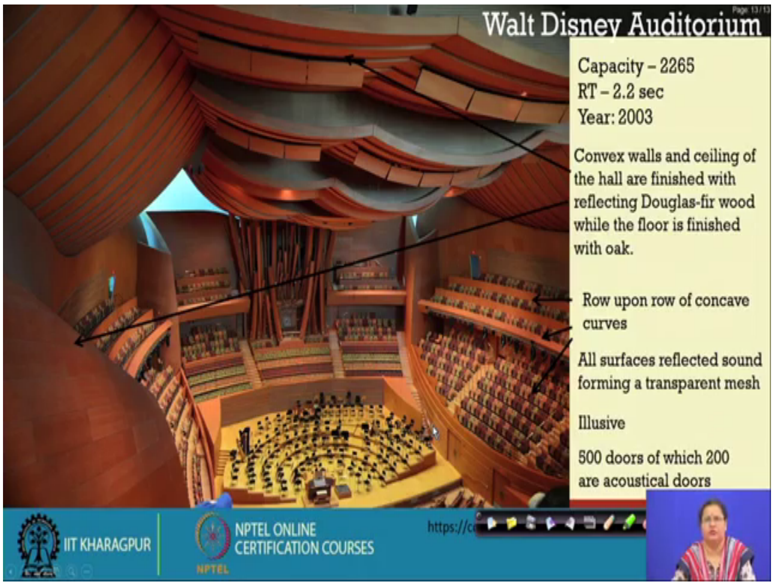

Now, come we come to the Walt Disney hall which is of 2003. This is like a vineyard the plan, if you see you will see it is kind of vineyard with here you can see all the sittings rows are concave curves. Whereas, all the wall profiles, all these profiles, are convex towards the stage and this creates a drama. All surfaces reflected sound forming a transparent mesh, it is an illusion the ceiling is made of convex surfaces, the sittings are made of concave surfaces.

So, sound actually it is a network of sound moving, a transparent network of sound moving inside giving it a elusive feeling. It also has similar to the verizon hall it also has 500 doors of which 200 are acoustical doors. You see the capacity here is 2265 and the reverberation time is 2.2 seconds. You can see the entire lining is of wood which is Douglas fir and the flooring is of oak wood.

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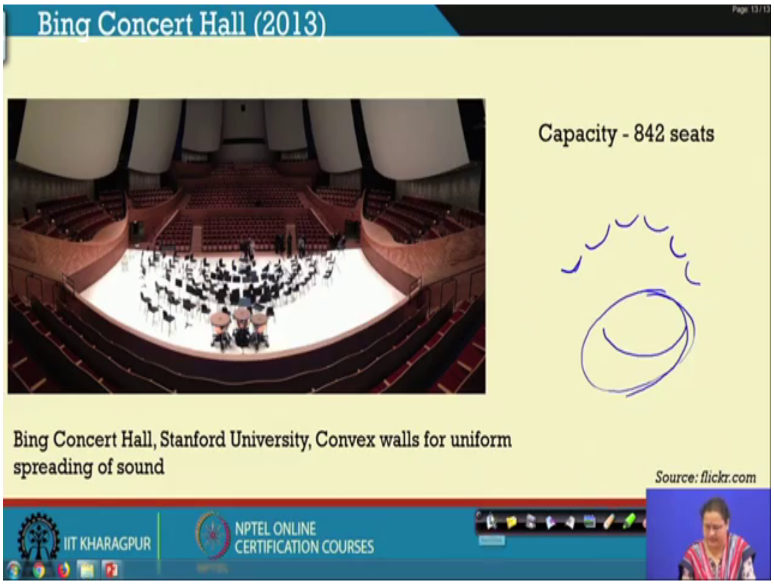

This is a very recent hall with a very small capacity 842 made in 2013, where you can see on the sides there are a number of number of convex towards the stage, wall surfaces and the ceiling over is also a convex surface. So, the ceiling is looks like a kind is very circular and on top of it where these all goes and merges the ceiling is hold over there.

So, it is the how the architect has designed it? But, following if you think properly, if you go to the earlier lectures you will see all the principles. The same principles are being adopted in all these halls to achieve a good sound quality.

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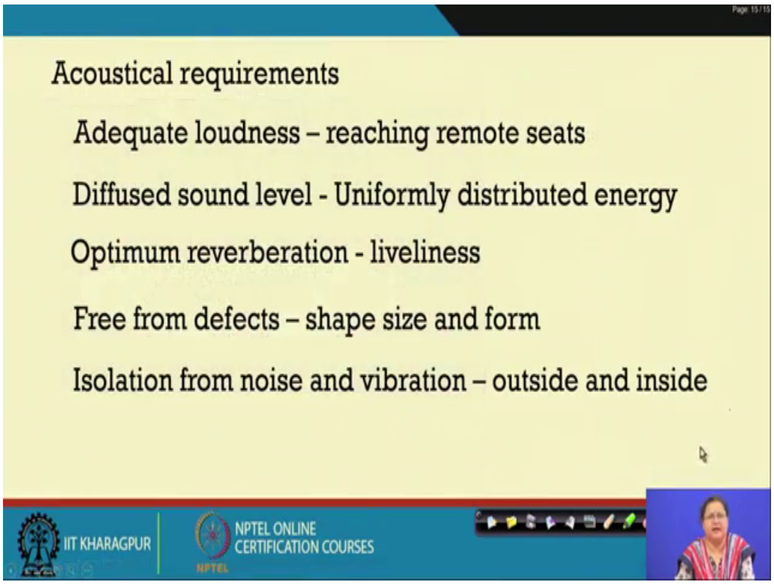

And so, we had started with the acoustical requirements of a good auditorium, with adequate loudness diffused sound level optimum reverberation free from defects and isolation from noise and vibration. The isolation from noise and vibration has not been touched upon here much, but we have tried to cover all these particular requirements which we started with.

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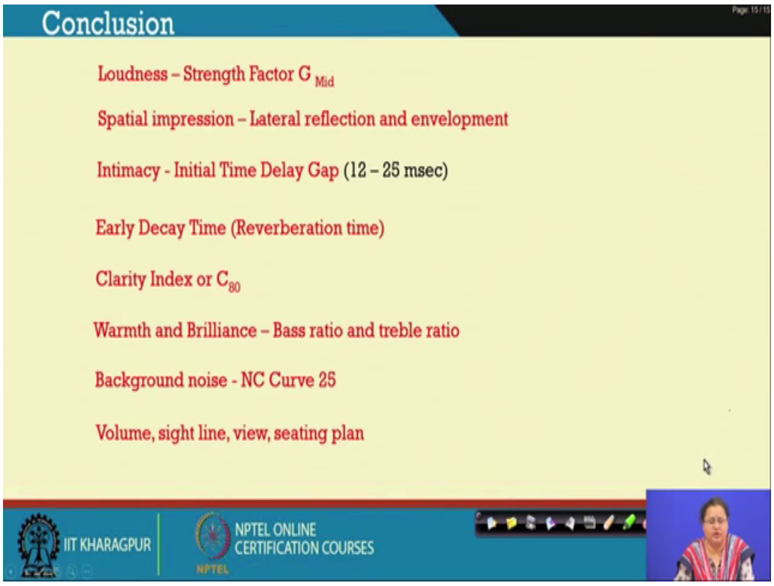

And, to conclude if you want a good quality acoustical quality loudness special impression intimacy early decay time clarity warmth and brilliance, background noise, volume, sight line, view, seating plan. If you account for all these things together, you will surely achieve a good sound quality at least better than, what you would have done without doing this particular course or without doing this particular module.

So, hopefully you will you have gained some knowledge to start with an auditorium design.

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So, here are some of the references for the particularly for the Sidney opera house you can see or browse through the references given over here. And, you can always visit the Wikipedia to get more of visuals that can help you in creating or developing the sense or sense; how you should treat your insight with this I finish this module.