Glass in buildings Design and Application
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Lecture - 22
Fundamentals of Daylighting_Part I

Hi, welcome to this course on technical terms related to daylighting.

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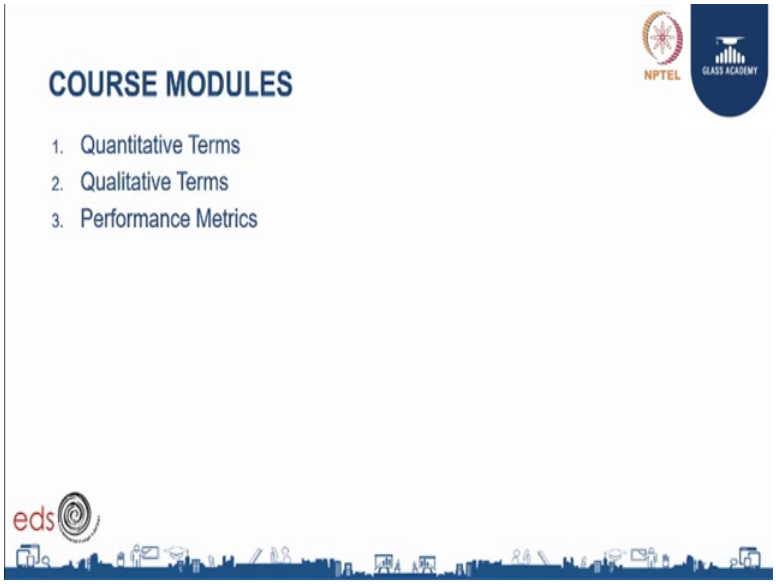

In this we will be talking about 3 terms; one will be talking about quantitative terms related to daylighting, second would be qualitative and we would be also covering the performance matrix related to daylighting.

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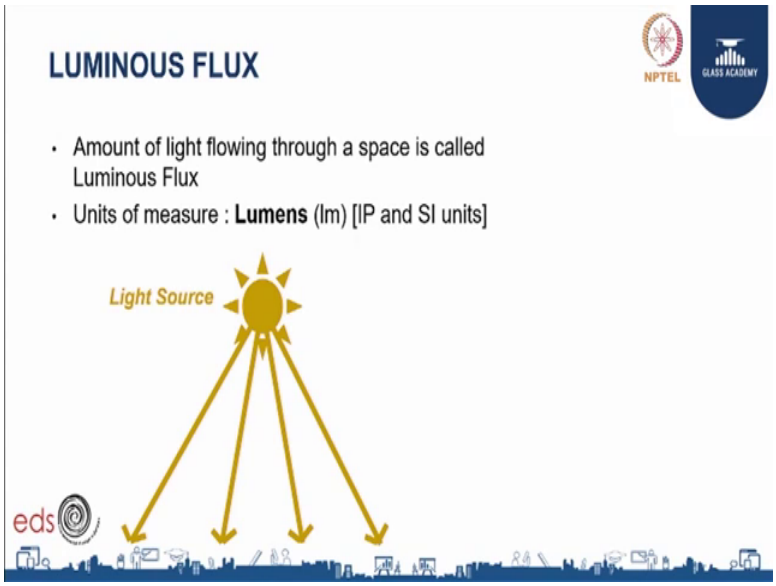

Let us start with the quantitative terms; the first term that I would like to discuss is on Luminous Flux. Luminous flux is basically the amount of light flowing through a space, it can be compared to a shower head to understand this concept, the unit of measurement of luminous flux is lumens and it is same in IP and SI units.

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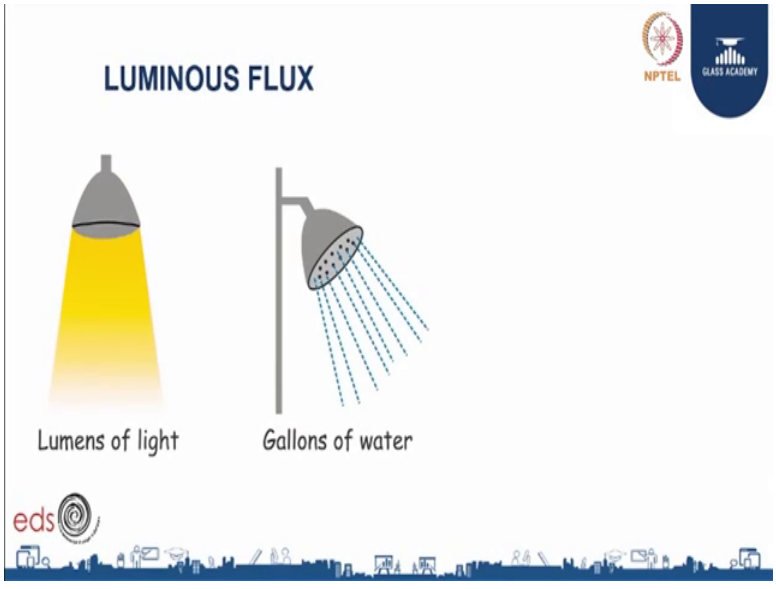

Just to compare it, it is basically you can compare it with hot water flowing out of shower and lumen flux is the lumens that are coming or flowing out of a lamp.

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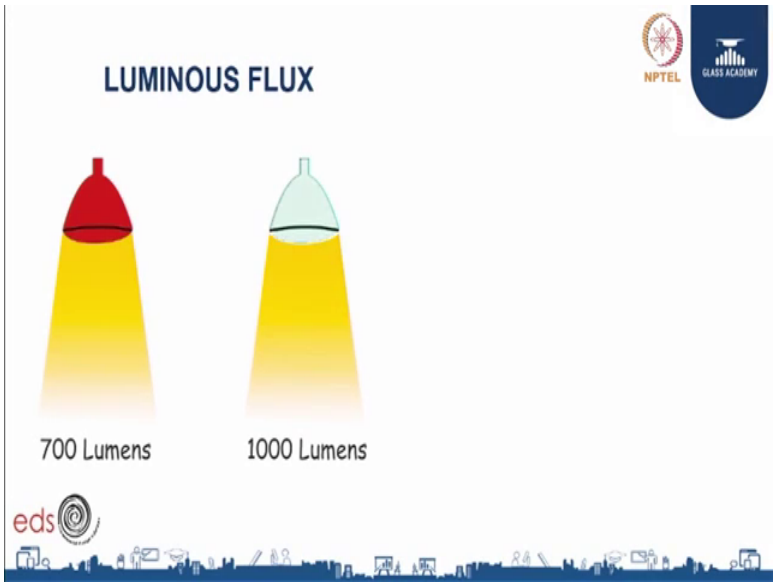

So, now let us just take this small example. So, we have a red lamp and a green lamp. So, the amount of light output or lumens out of the red lamp is around 700 lumens and of green is 1000 lumens. So, from lighting prospective it is clear that you know you would like to go with a fixture which has got higher lumen outputs because you will get more of light output from that fixture.

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This brings to us an important concept of energy use. So, let us try to correlate the lumen output with an energy use.

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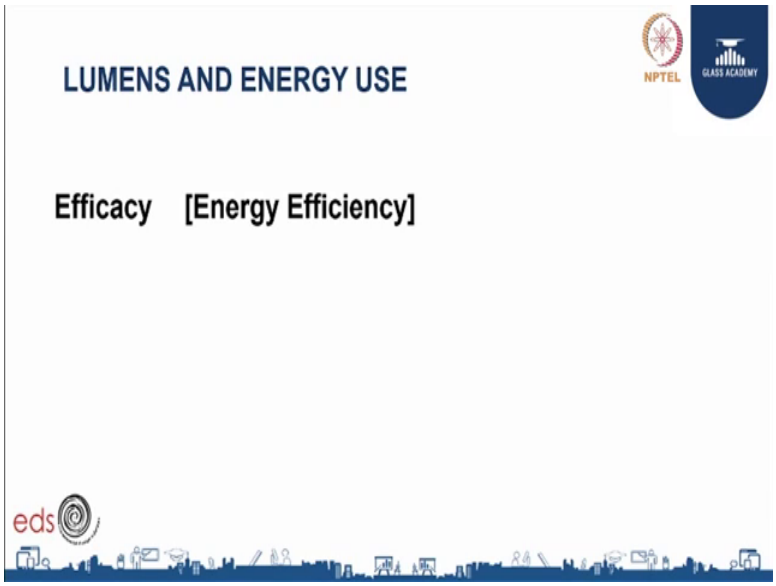

So, that brings us to a term called efficacy, efficacy is a simple term or is called an energy efficiency.

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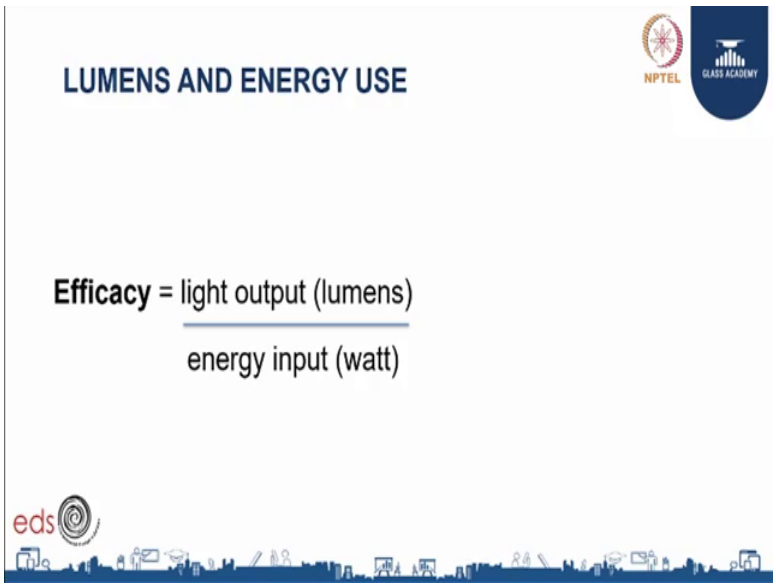

It is basically the light output divided by the energy input; so, light output in terms of lumen and energy input in terms of watt. Basically, what it means is for every watt of electricity used what is the lumen output from that lamp? So, now, let us just revisit that same example.

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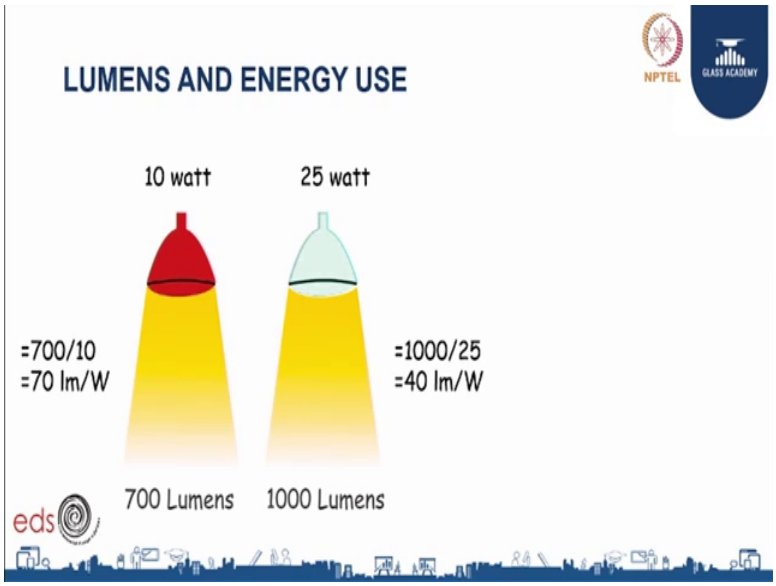

So, with the red and the green lamps giving 700 to 1000 lumens, now let us add the voltage to that. So, my red lighting fixture is consuming around 10 watts and the green is consuming is consuming 25 watts. Now if we translate this into lumens efficacy value, so, we get 70 lumen per watt for red lamp and 40 lumen per watt for green lamp.

So, it is now clear and this changes the perspective that now from energy use perspective I would definitely like to go with red lamp because it is giving you more lumens more light to output compared to the input of energy electricity into the fixture.

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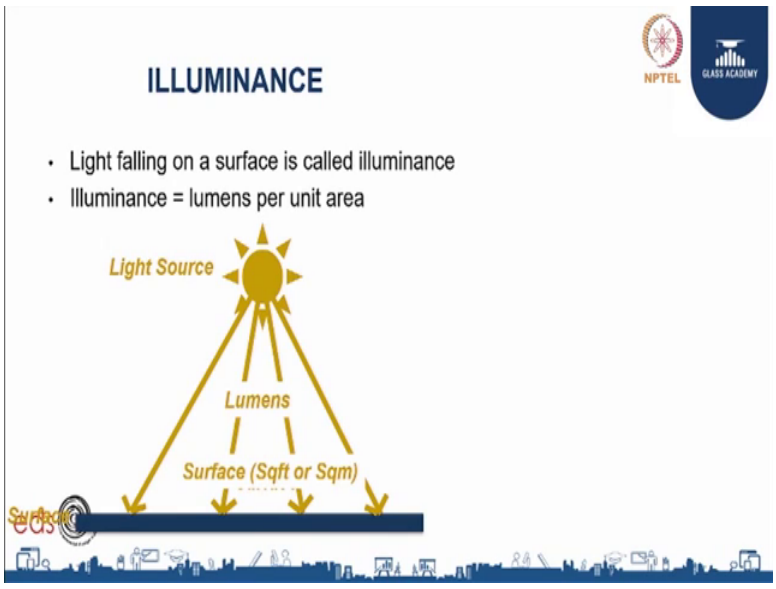

Now, moving to the next term is illuminance, lumens flux we have understand, now let us get into illuminance. iIlluminance is the amount of light falling on a surface and it is basically the and the surface is generally measured in square foot and or square meter. So, you can translate this into it is basically lumens falling per unit area of a surface.

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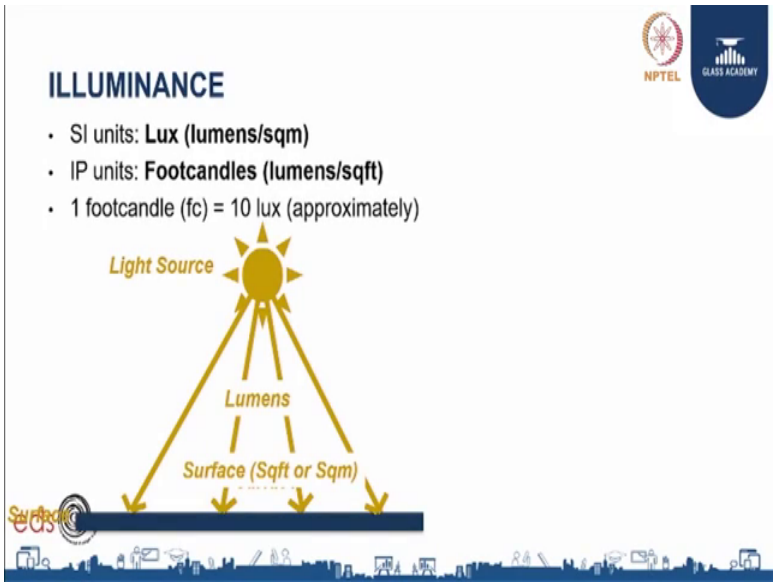

In terms of measurement, it is measured as Footcandle in IP units and as Lux in SI unit. It is different just because there is a square meter and square foot difference. So, 1 footcandle is approximately 10 lux that is the correlation between square foot and square meter.

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Illuminance can be measured by light meter or you have to do is take this light meter and hold it near to the surface and it will give you the amount of light that is falling on this sensor and on that surface.

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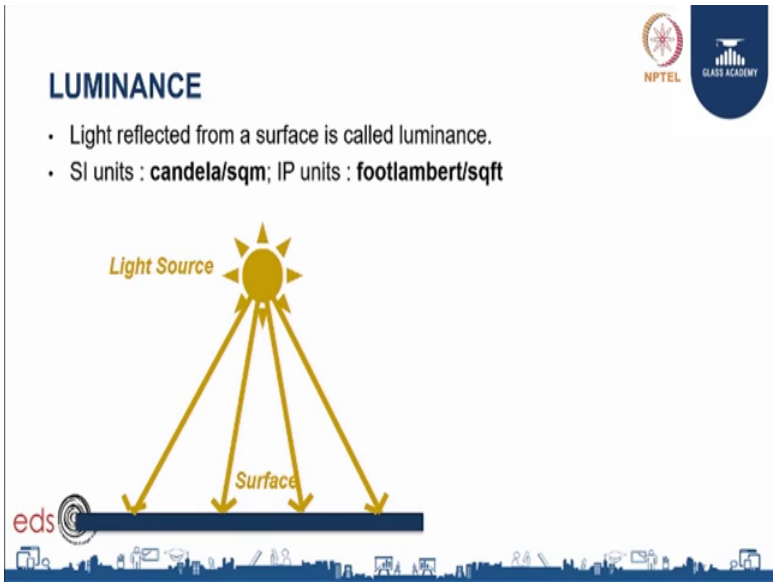

Now, let us come down to luminance. So, whatever light is falling on a surface is kind of reflected back; so, that is called luminance. So, light reflected from a surface is called luminance. As per a definition, it is measured as candela per square meter in SI units and footlambert per square feet in IP units.

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Luminance again can be measured by light meter or the only change is now you have to hold the centers hold the sensors away from the surface. So, that you know you can measure the light reflected from that surface.

Generally you can also some somebody will would feel that you know you can correlate that luminance that if a surface is appearing brighter; that means, it has got higher luminance value. So, for example, a white colored wall will appear brighter than a brown color wall, in such cases one would think that you know the luminance of the brighter surface might be higher than the other surface let us just get into that because this that is not always the case.

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Brightness is perception of human observer. So, it is basically qualitative aspect which you will be covering in the second module whereas, luminance is an objective measurement of a light meter hence it is a quantitative aspect.

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Just for a simple example lights will generally appear much brighter at night than during the day in the same space, but we will register, but if you if you take the light sensor and measure the value you will have same luminance value from the light fixture.

Since we design lighting for people and not for light meters it is usually important to focus on brightness than luminance.

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Again let us just understand now more detail into the qualitative terms. So, that comes that brings us to the 3 qualitative terms.

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Which are brightness, contrast and glare? Let us start with brightness.

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As we have already explained human being judge brightness of an object, relative to the brightness of the sounding so, brightness is cannot be measured it is basically human perception depending on the surrounding conditions how bright are the surrounding, what are the surface material, you perceive brightness in that stand.

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Another example, you know you have car head lamps which are very bright very bright at night you feel you cannot even you know look into that.

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And if you see the same during the day you will not feel you will not even notice that the head lamps are on, so, that is the perception of a human being.

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Let us just look at in simple example. So, this is a scenario where you know let us just try to identify whether this left triangle is right or this right triangle is bright. So, just let us take a moment so, I think you must be ready with the answer let me just guess I think you would be thinking that the triangle on the left side is brighter than that triangle on the right side.

So, now, just let us just remove the top 2 black and white triangle and see. So, now, one can clearly see that the left and the right triangle were of the same color. So, it is just because we have created a surrounding around the left triangle which is dark and a around the right triangle which is light which is making the left angle appear brighter than the than the right triangle.

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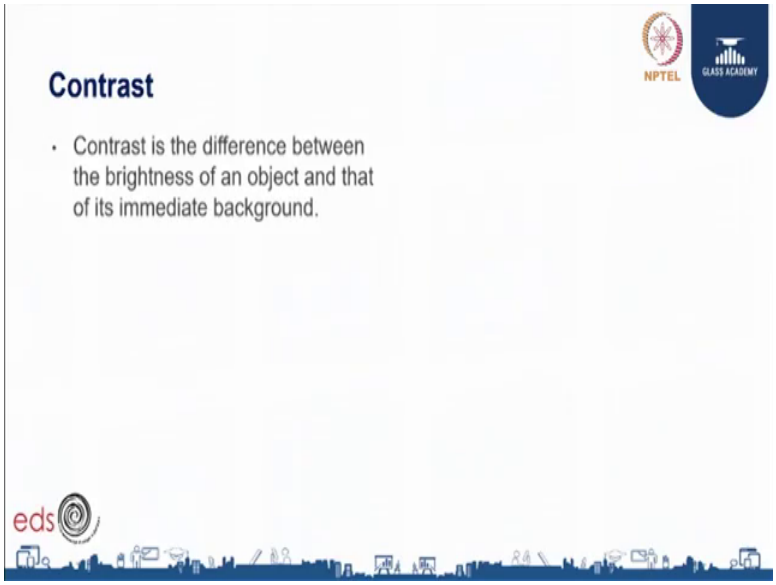

Now moving on to the contrast by definition contrast is the difference between the brightness of the object and that of it is immediate background.

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Now, in this image we see dark colored windows popping out of a light colored wall. So, that is that is it is immediate surrounding and it helps in the contrast basically helps in visual task performance, just let us just change the contrast of this image and then see how that is impacting our visual.

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So, now if you see eventually with excessive contrast will reduce visibility. So, this is called glare we are already not able to see some of the details due to excessive contrast. It is the visual noise that interfaces with the visibility and an extreme object against a dark cause background also causes this comfort and can interfere with visual perception, this is generally termed as glare.

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There are 2 types of glare, one is direct glare which is caused by beam of light or a surface sufficiently bright to cause discomfort and loss on visibility, you can look in this photograph the bright sun is shining right through the street reducing the direct visibility in the immediate surroundings you can have a dark glass to reduce the glare or shield the sun where your hands. So, that it is not in the field of vision in order to improve visual comfort.

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Again another example of glare which is you know there is a bike and there is a sun behind and you cannot see the details of the bike in this image though it is a great image interesting photo composition though.

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Again, a reflection of light sources on glossy surfaces, which cause problem similar to direct glare.

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