Engineering Drawing and Computer Graphics

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MODULE 01

LECTURE 03: INTRODUCTION TO ENGINEERING DRAWING -III

Hello everyone, welcome to our NPTEL online certification courses on Engineering Drawing and Computer Graphics.

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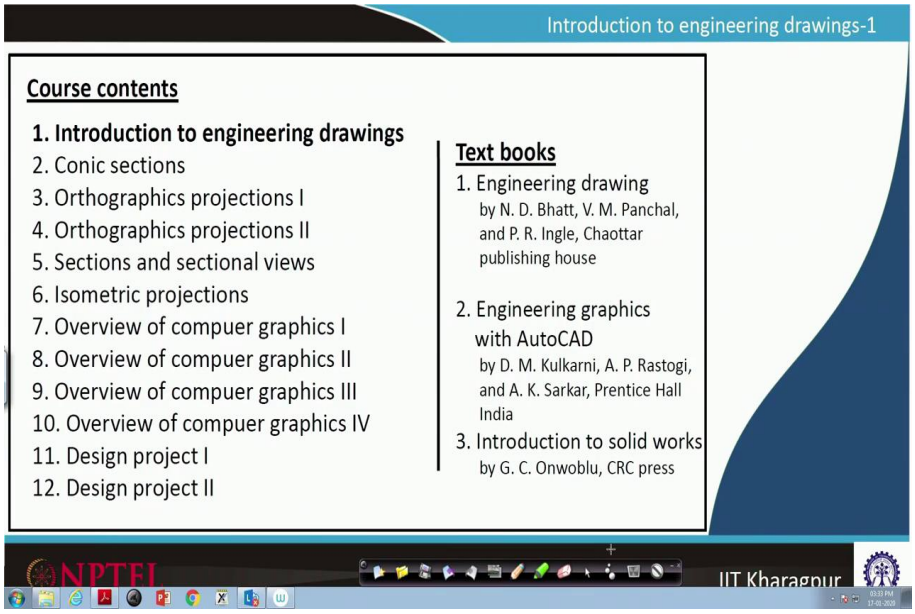

This course contains engineering drawings, conic sections, orthographic projections, sections isometric projections, and overview of computer graphics and few design projects.

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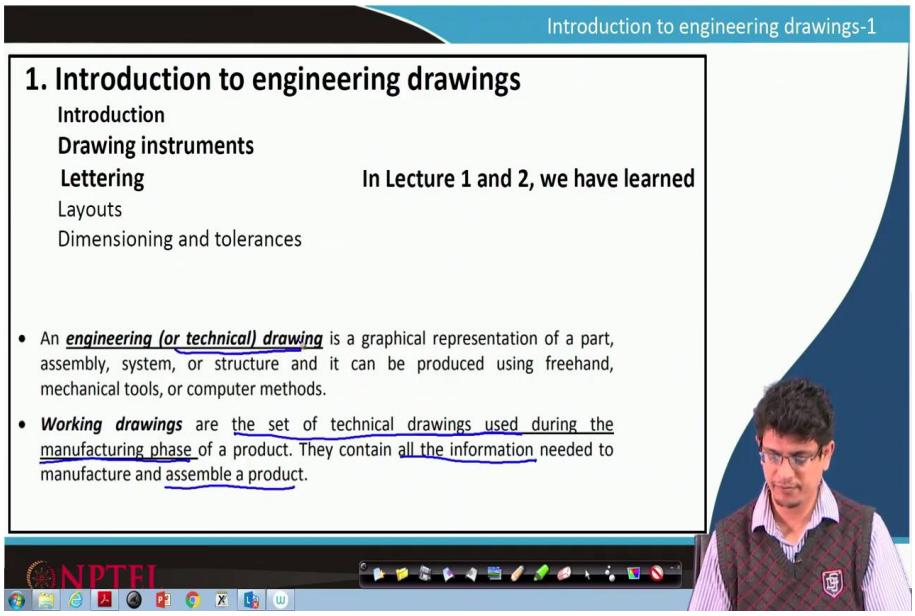

In the last two lectures, we covered the introduction to basic drawing instruments and lettering system to be followed for any drawing. There we have learned that an engineering or a technical drawing is a graphical representation of a part, assembly system, or structure and can be produced using freehand or mechanical tools or using computers.

Once engineering or technical drawing is done, it will be sent to production, and that drawing will be called working drawings. In working drawings are the technical drawings used during the manufacturing phase of a product; they contain all the information needed to manufacture and assemble the product. In our course, we mainly focus on engineering or technical drawing.

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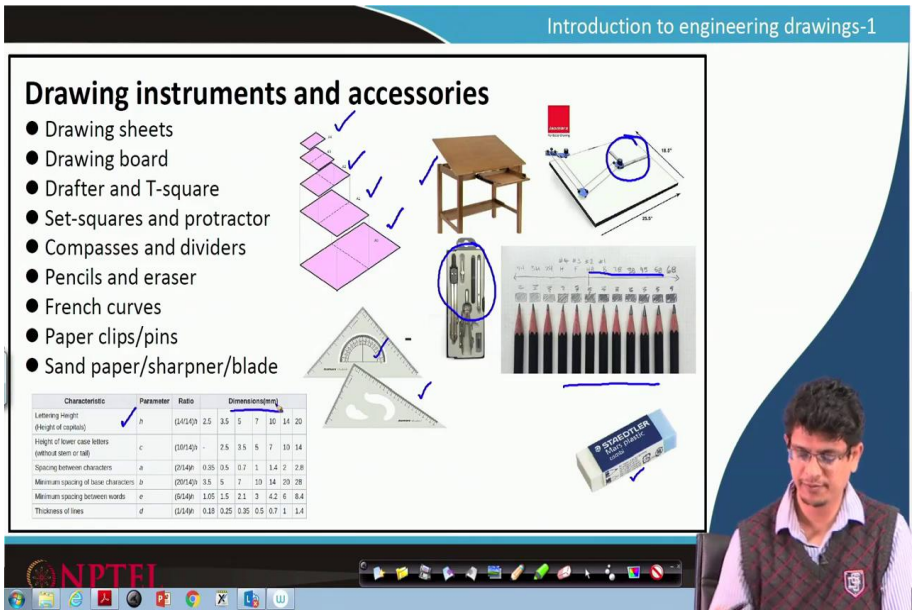

In the last class as a summary, we have tried to look at the different drawing sheets used A0, A1, A2 to A4, and their standard sizes. We have also covered the kinds of tables to be used for getting better drawing and also the main accessories like mini drafter, compasses and dividers, pencils of various shades, and their grades the other accessories like set squares and protractor and other essential components like an eraser, etc. And then we covered the lettering to be used, the height of a letter, the thickness of a letter if it is lowercase or uppercase what kind of dimensions one should follow we try to look at.

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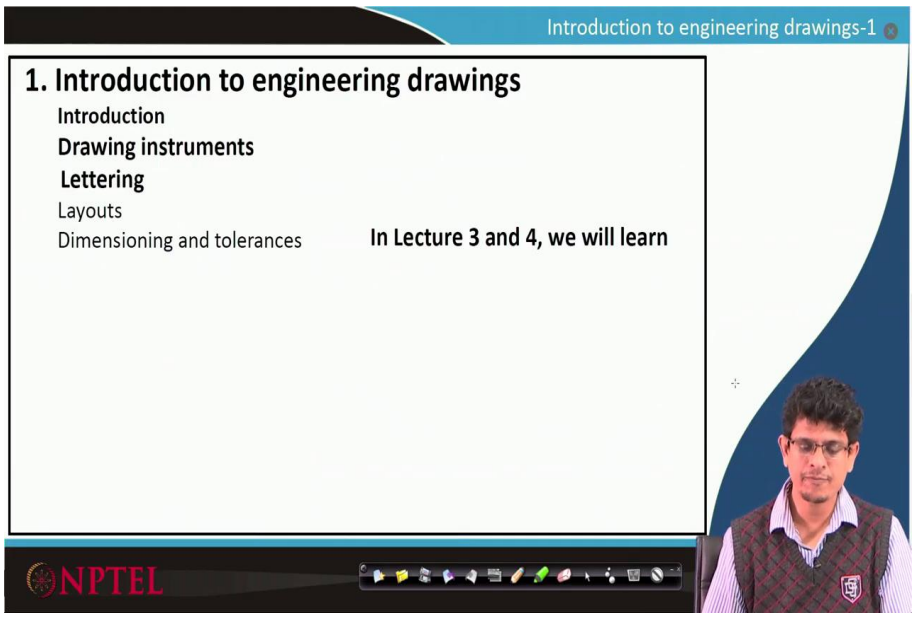

In today's lecture, we will cover the layouts used for a drawing sheet and dimensioning and tolerances to be used or mentioned in a drawing sheet. And we will mainly understand how to dimension a line, curve, and other things and address these tolerances issue.

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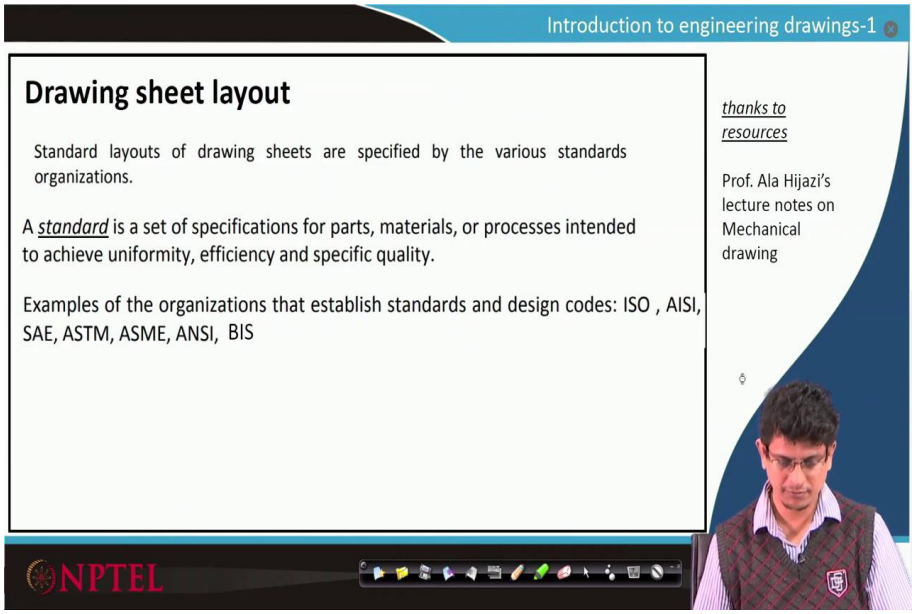

In this drawing sheet, standard layouts have to be used, and different organizations specify these standard layouts. In this, a standard is a set of specifications of parts for materials or processes intended to achieve uniformity, efficiency, and specific quality.

So, these are the protocols that one has to follow. Examples for standard organizations are ISO, AISI, SAE, ASTM, ASME, ANSI, and BIS. ISO is International Standards, SAE is Society of Automotive Engineers, ASME is American Mechanical engineering associations, and BIS is the Bureau of Indian Standards. Each of these organizations follows a different kind of standard. Still, these days people are trying to locate for universalization of these standards, and mainly for our drawing sheets, we go with Bureau of Indian Standards.

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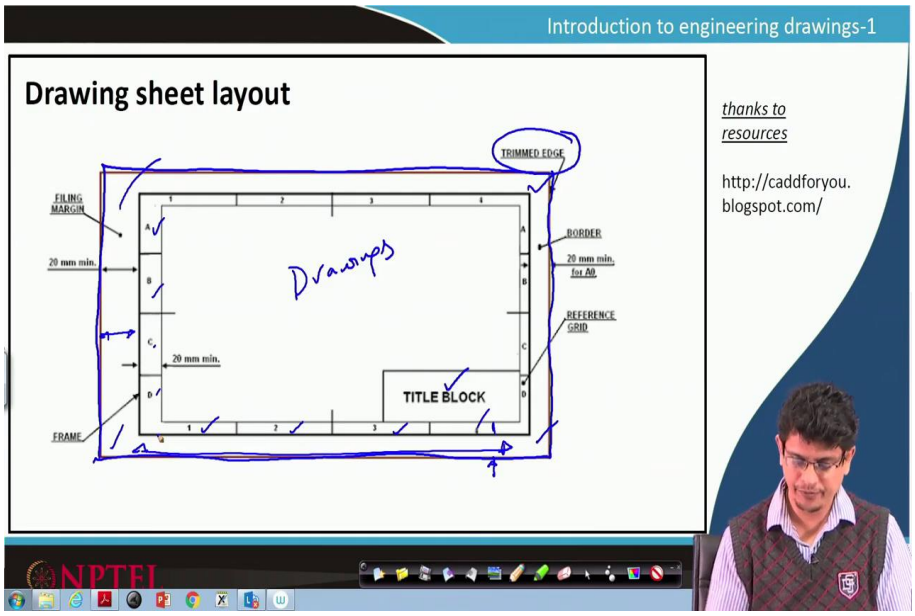

Let us look at a template of a drawing sheet layout. Here, the thing that we are showing trimmed edge is the paper up to which the cut has been done. The A0 sheet or A4 sheet is available up to this length and width, and those edges are called trimmed edges. In the drawing sheet layout, we usually see title block perhaps a variety of drawings here within this space, some border information, some kind of letterings like A, B, C, D, and some numbering like 1, 2, 3, 4. One has to follow standard protocols to know how much space has to be left between this title block and edges and what should be the border-line width and the length of that drawing.

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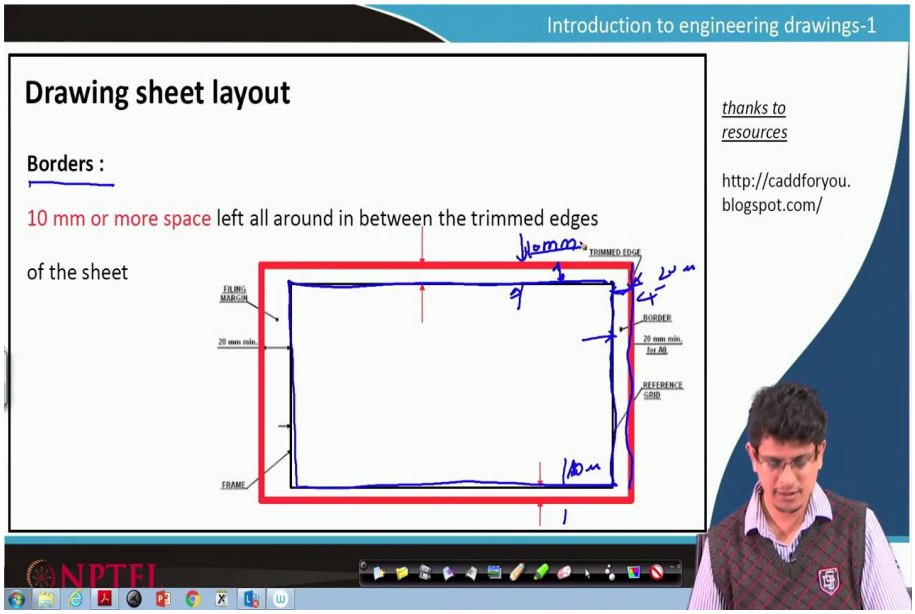

In this class, we will look at in detail for the drawing sheet layout. The first one for a drawing sheet layout is "Borders." Usually, 10mm or more space left all around in between the trimmed edges. So, the sheet is available up to that level, and we are calling that one as the trim sheet, and from there, we usually construct a rectangular block with minimum spacing as 10 mm or more. Anything more than 10 mm is always recommended.

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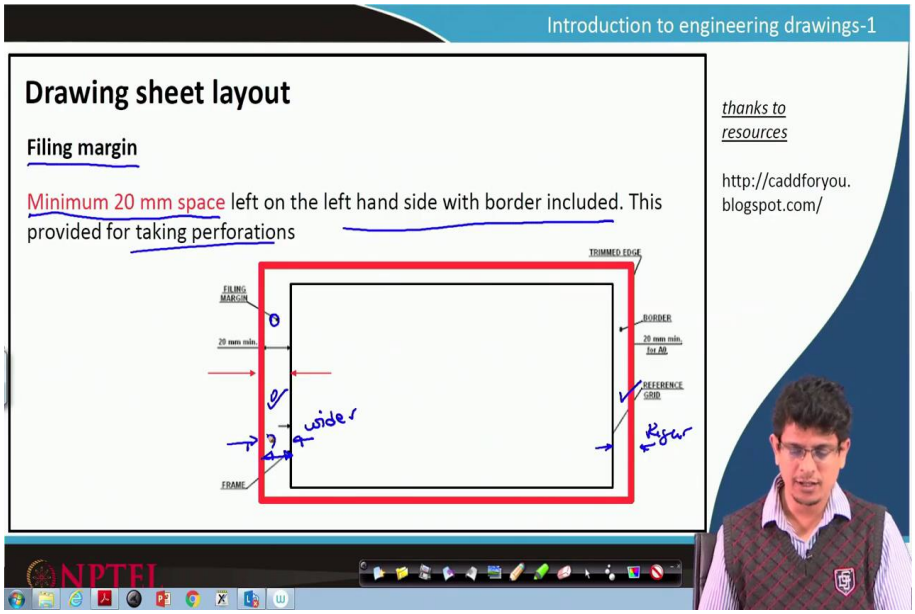

The next one is filling margin if we see from right-side to left-side the width of these border-lines is a bit wider on the left-hand side. That space extra space whatever we are going to use minimum 20 mm space one has to leave that is on the left-hand side with border included. This is provided for taking perforation. If someone would like to staple these drawing sheets or perhaps make holes keep a record, this extra space will be used.

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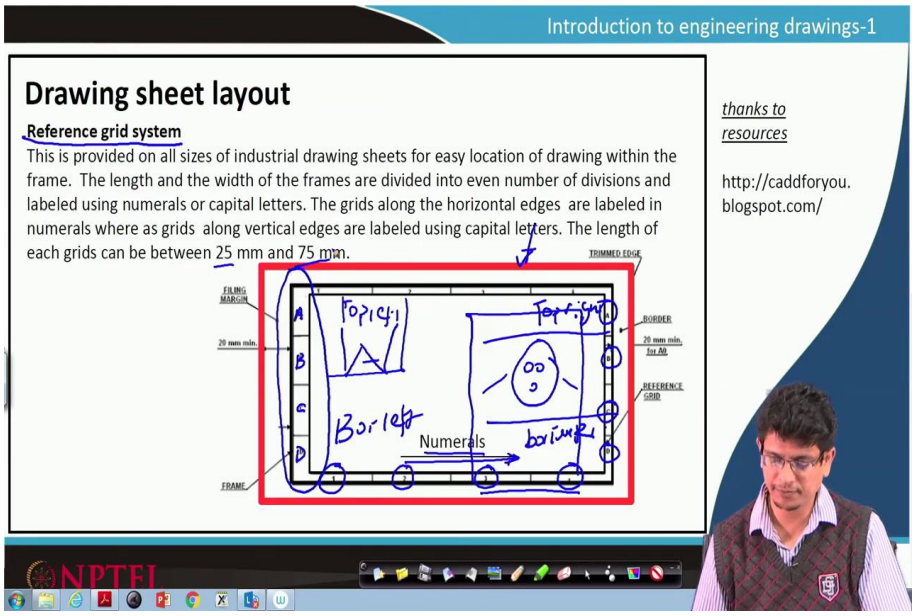

The other one for a drawing sheet layout is called the reference grid system. This is provided on all sizes of industrial drawing sheets for easy location of drawing within the frame. The length and width of the frames are divided into an even number of divisions and labeled using numerals or capital letters. If we are looking at this on the drawing sheet, we can see a reference grid system. In the vertical direction, we give capital letters A B C D starting with top left corner and here also we see A B C and D.

Similarly, in the horizontal direction, we see numerals 1, 2, 3, and 4. For example, we have a drawing of this here, there might be another drawing of the same either part or other things here. To better convey this message we usually go with this reference grid system the part will be in that reference grid system like 3, 4, and C and B information. So, this A, B, C, D, and 1, 2, 3, 4 represents the parts of the different areas of the drawing sheet, for example, here W is in A-B zone in 1-2 zone on the top right side top left top right bottom left and bottom right.

The grids along the horizontal edges are labeled in numerals whereas, grids along the vertical edges are labeled using capital letters or uppercase letters. The length of each grid can be between 25 mm and 75 mm depends on the drawing sheet we use these lower limits or the upper limits.

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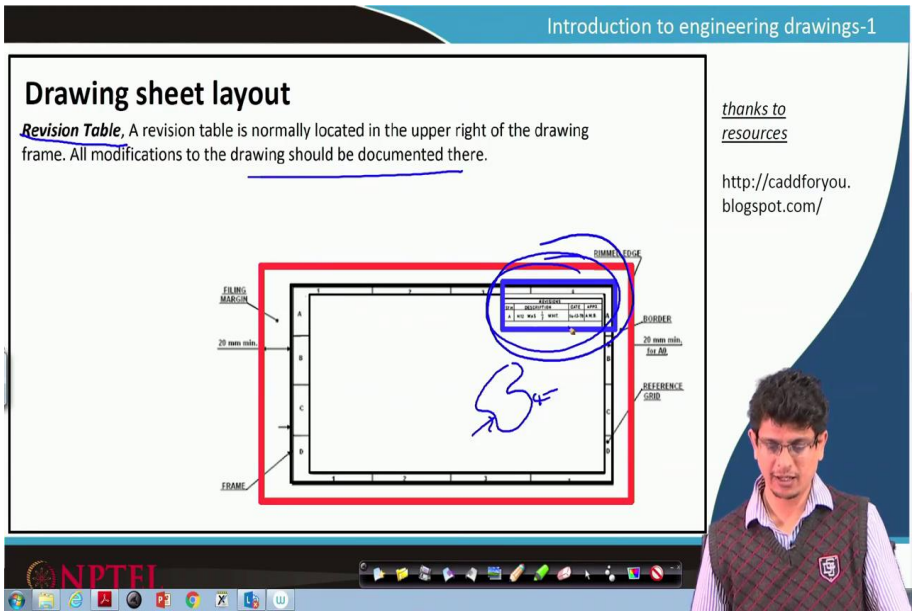

The other essential component of this drawing sheet layout is the revision table, here we can find that revision sheet. A revision table is normally located in the upper right of the drawing frame all modifications to the drawing should be documented there. Usually, for these engineering drawings once the component is meet and if there is any revision required one more drawing sheet will be provided with the revision. For the drawing sheet usually, the technical content of the information will be provided as a table that's what we call the revision table.

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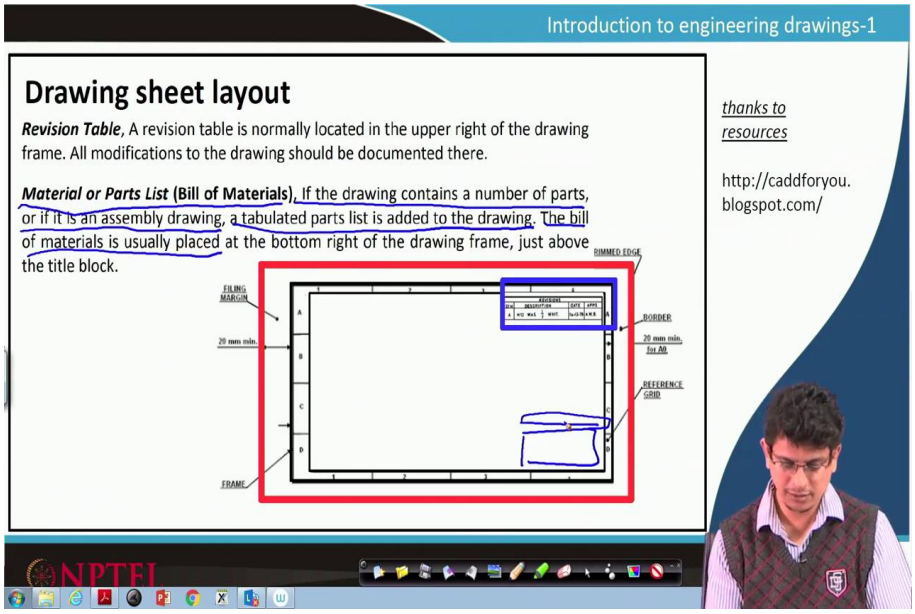

For production drawings, the components involved in the drawing for example, like one part is made with brass, the other part is made with bronze, the other part is made with iron. So, these different materials have to be mentioned. So, for their purpose material or parts list which is called the bill of materials, is

also included. If the drawing contains several parts or if it is an assembly drawing a tabulated part list is added to the drawing. The bill of materials is usually placed at the bottom right of the drawing frame just above the title block usually we have title block here above that we have this.

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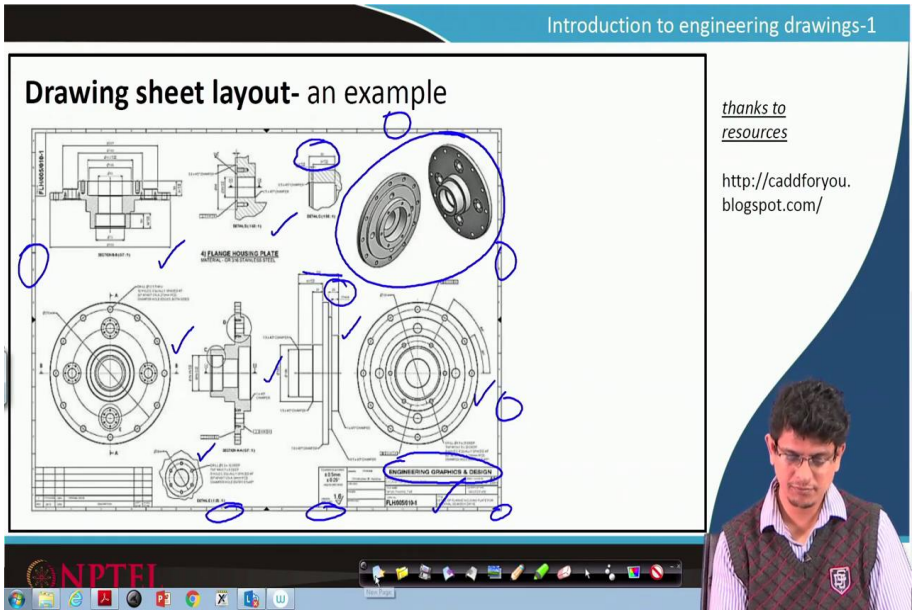

Let us look at an example of a drawing sheet. So, the drawing sheet with lettering the reference grid systems in which we can see it. These are the reference grid system. we can see the title block and the basic components we can see the isometric views, the three-dimensional objects, and their projections views we can see it. If any inner details and so on to be shown that will also be shown. We can see that capital letters have been used for the title block and here we can see some kind of numbering kind of system, there are lines and some numbers these are called dimensions and we will see it later.

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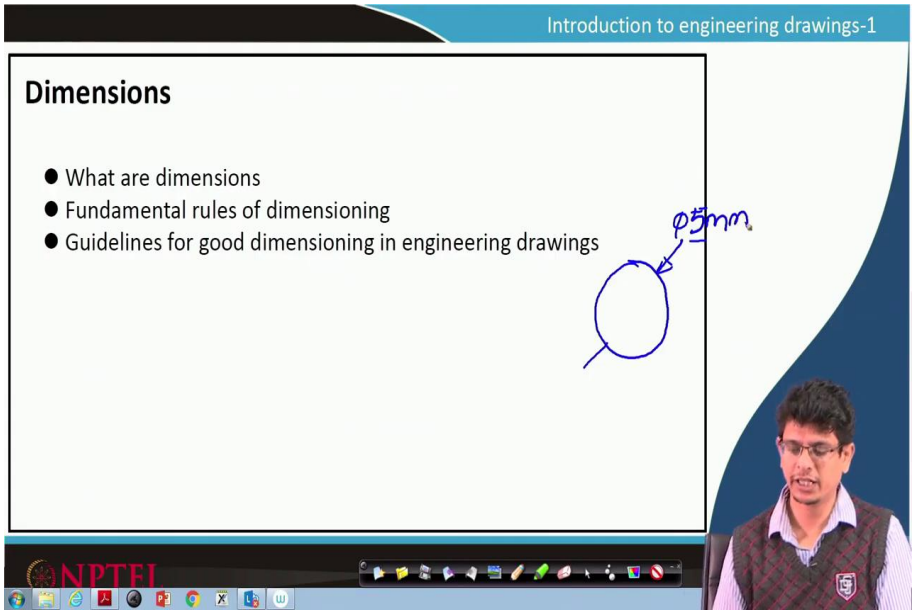

Now, coming back to the dimensions of the drawing sheet, where we have shown the pictures, for example, something like a circle with the diameter and so, on so, things how to name such kind of things we are going to look at in this section. In this, we look at what are the dimensions involved, fundamental rules of dimensioning, guidelines required for good dimensioning in engineering drawings.

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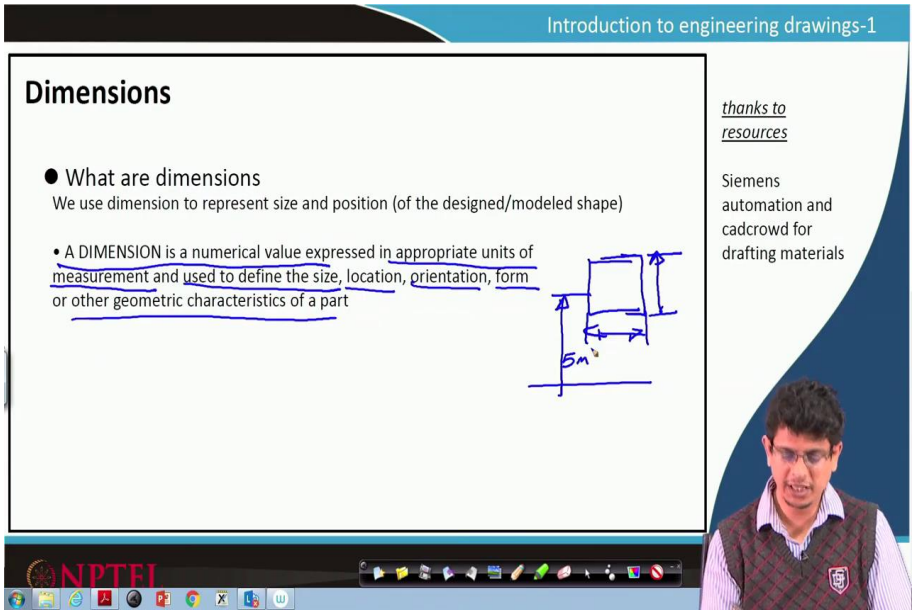

Let us look at the first part what are dimensions. We use dimensions to represent the size and position of the design or model shape. A dimension is a numerical value expressed in appropriate units of measurement and used to define the size location, orientation, form, or other geometric characteristics of a part. For example, I want to represent this rectangle, then naturally, I have to mention what might be height and what might be its width and length. Perhaps, it might be 5 meters above the ground level. So, this kind of dimensioning which we are going to learn in this lecture.

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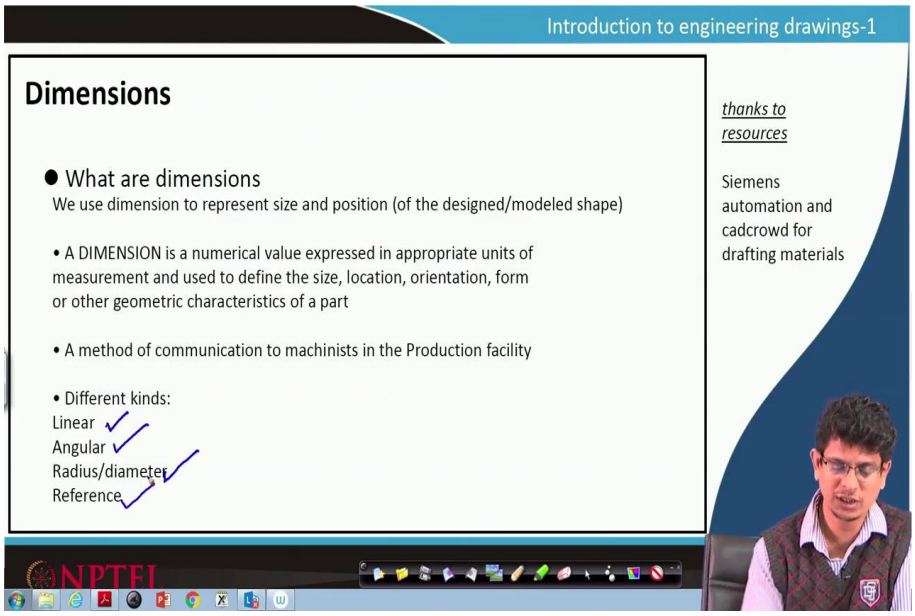

A method of communication to machinists in the production facility requires proper dimensioning. This dimensioning of these drawing sheets is that the technical information is of different kinds. They can be linear dimensions; it can be angular perhaps representing radius or diameter of a cylinder or part of a curve and with respect to a certain reference scale.

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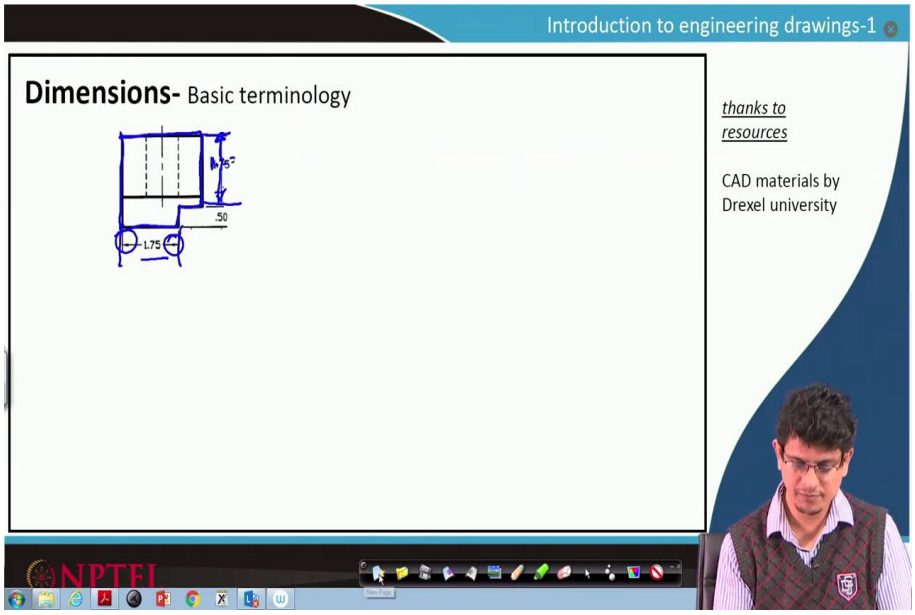

Let us look at the basic terminology of dimensions. Here we are showing an object of a particular shape, there we are showing something like lines and arrow and some numerals with certain decimals. Similarly, here also we are showing some numerals with arrows those are called dimension.

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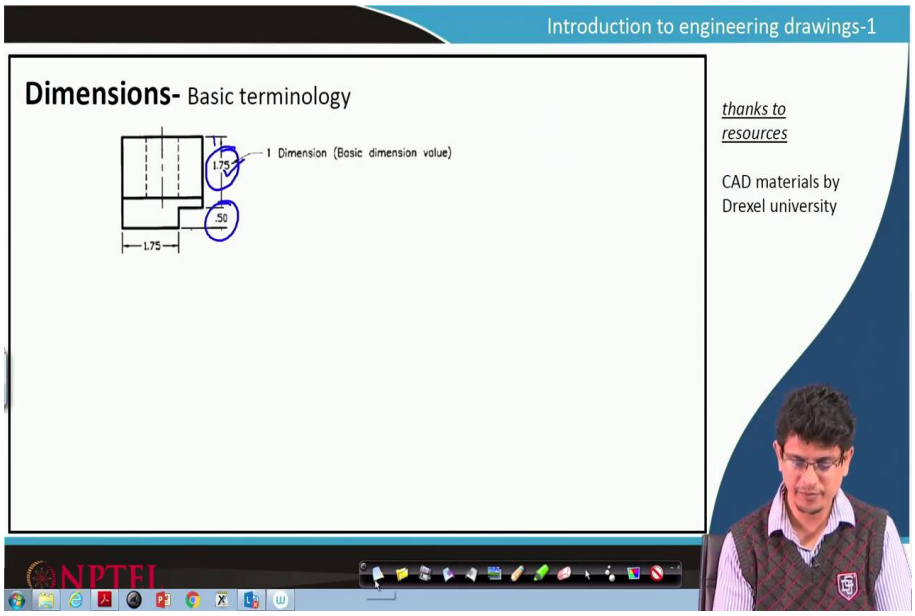

Precisely these are the large scale information. So, we call that as basic dimension value.

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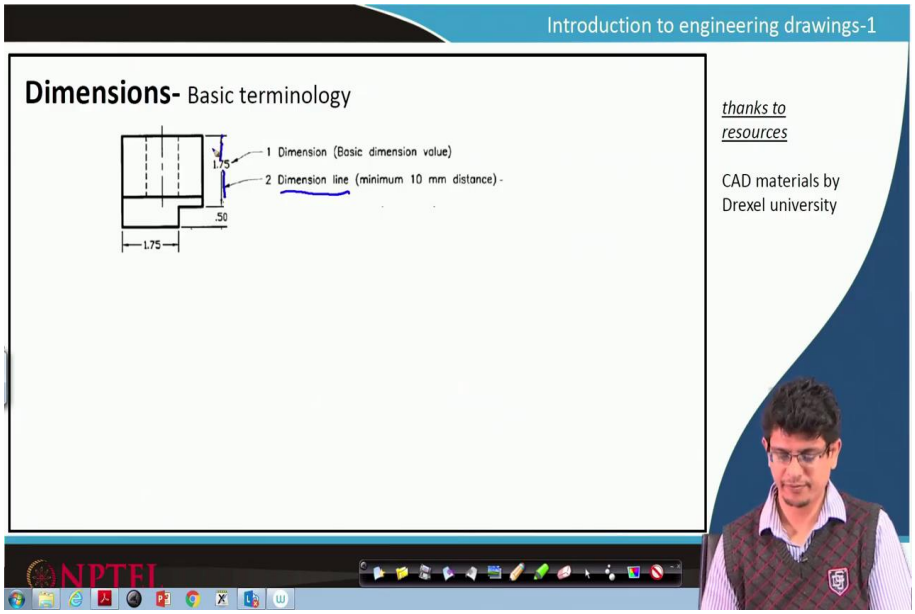

To represent dimension, we require a dimension line. So, there is a line.

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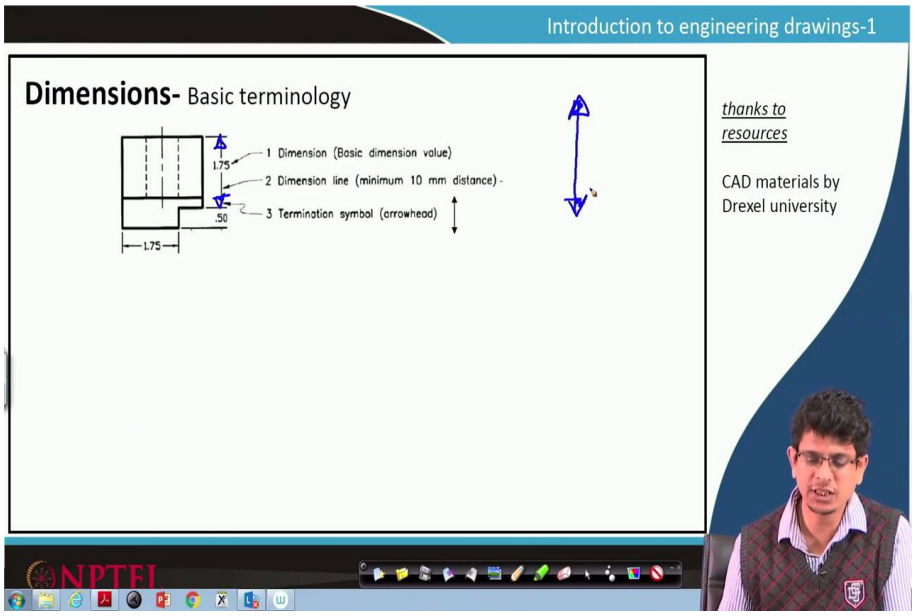

When the dimension is ending, we show it by an arrow. So, a line with an arrow is called a termination symbol. Any length scale which we would like to use we have to show it by line with arrows terminating heights.

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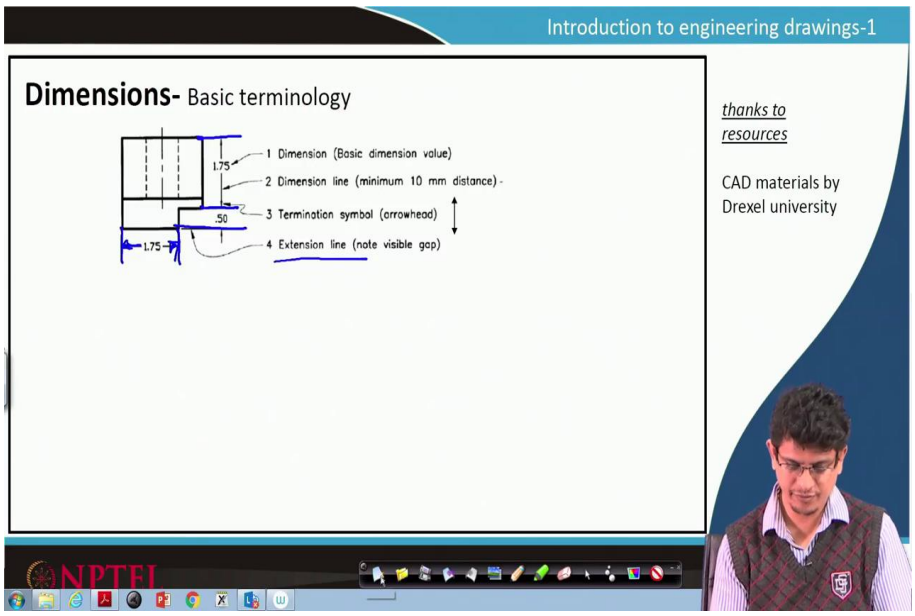

When we are showing dimensions occasionally, we write draw lines. For example, here this one and this one these are not part of the drawing, but to represent these dimension lines we usually draw what is called extension line.

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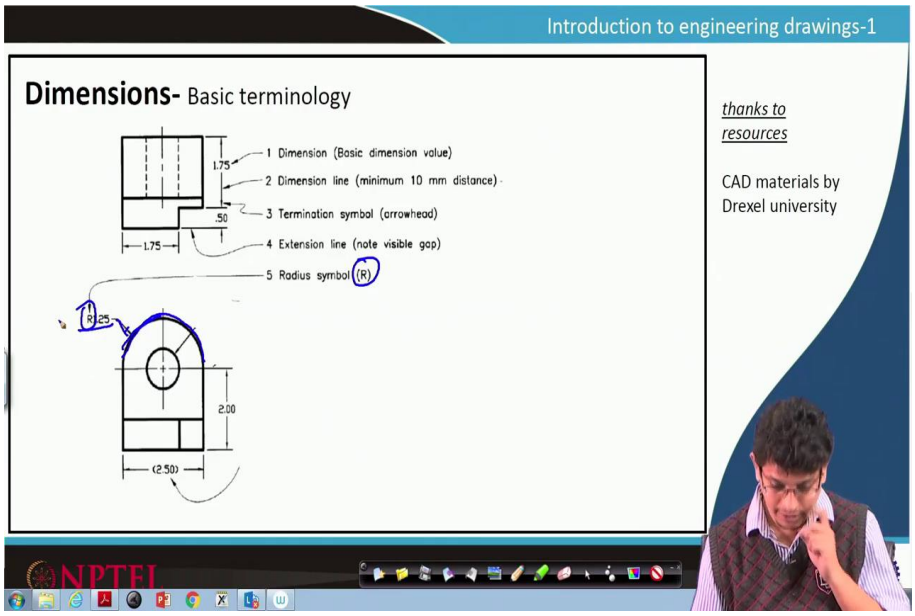

Whenever curves are involved it is a common practice to show the radius of that dimension.
For example, here we have a semi-circular arc. So, it must be having a radius of 1.25 and for radius symbol, we use the letter 'R'.

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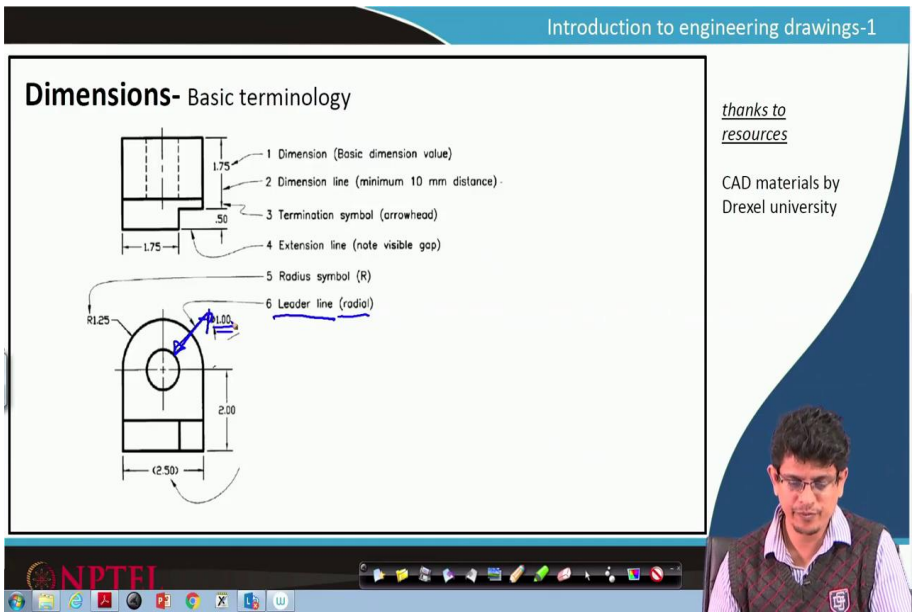

Here we are showing the leader line this is also a radial line. So, we can see there is an arrowhead going in that direction, phi represents diameter symbol and 1.0 is that dimension value.

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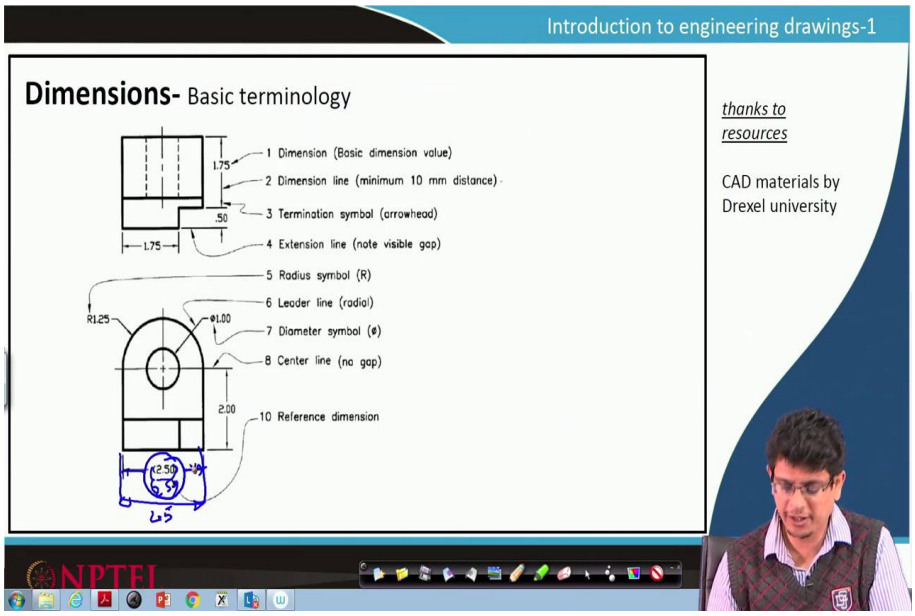

So, whenever the diameter symbol has to be used usually we go with 'phi' Greek letter and whenever it is radius we go with capital 'R'. There is one more line called centerline whenever we have cylindrical objects and we would like to show about that axis, we go with these center lines.

Whenever we would like to represent reference dimensions we use that parenthesis and 2.50 it indicates that this length supposed to be 2.5 may be in the drawing it might not be 2.5, but whenever people would like to simplify these dimensions just to represent they use these parentheses with the letter 2.5 and arrowheads, that kind of dimensions are called reference dimensions. These are the extra dimensions given just to represent the drawing. This dimension must have been already given in the drawing as intricate detail.

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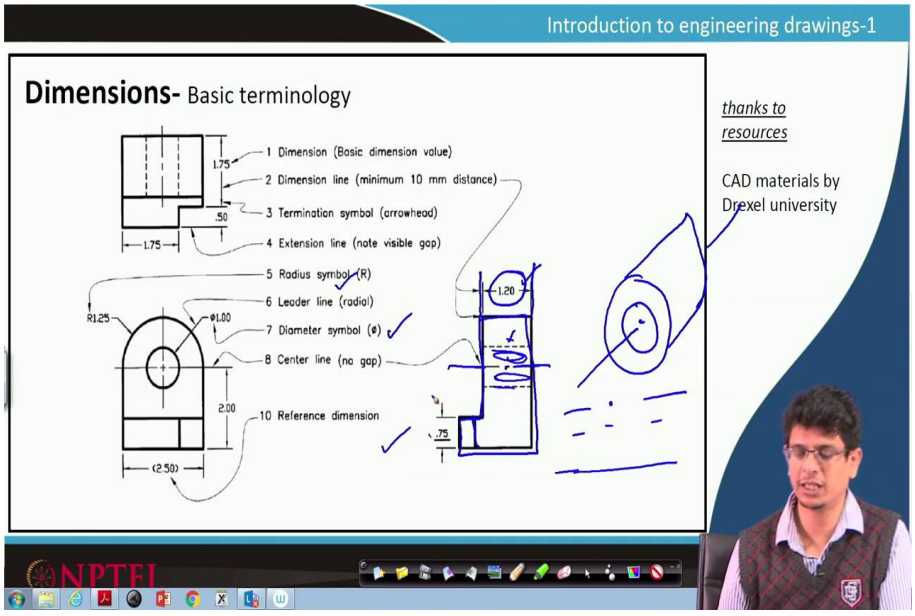

Let us look at another drawing. Here we are seeing this shape, we can note here there are extension lines with 1.20 as the basic dimension, here also we can see that there are center lines whenever we have cylindrical objects, for example, this is the cylinder, cylindrical portions and would like to represent something like an axis we use that center lines.

Whenever material has been scooped out to show that or whenever there is material is about to begin, we show it by these dashed lines. These are the inside details during our course we will learn about what are these dashed lines and also dash-dot lines and what are these continuous lines also. As of now, we will look at here dimensions and radius symbols, diameters, and these reference dimensions.

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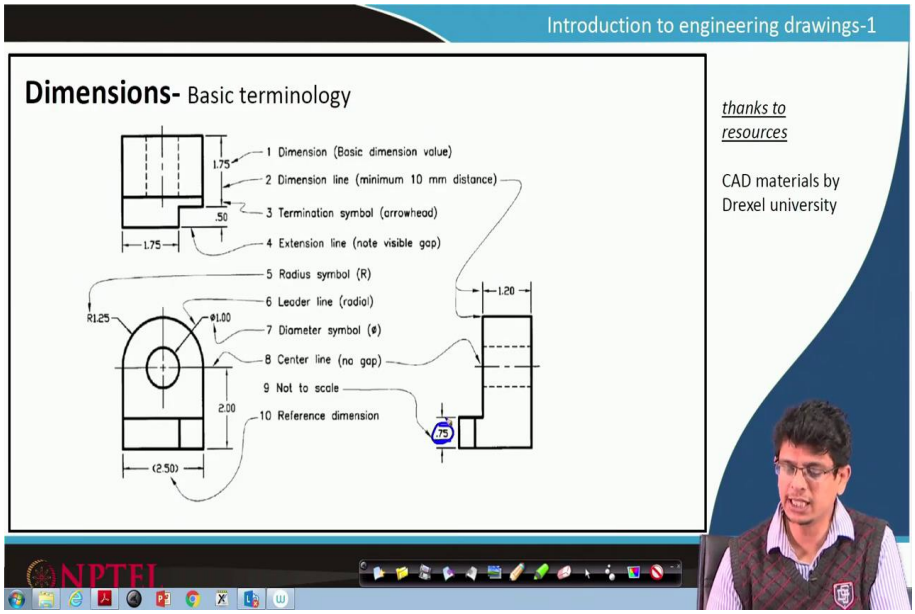

Whenever there are not to scale dimensions, usually, we represent it by that arrow a line indicating 0.75 whatever the dimension is involved in that, we show that that dimension and whenever not to scale we just leave an underlined. So, the distance between these two points is 0.75 in this case.

Thank you very much.