Engineering Drawing and Computer Graphics

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MODULE 01

LECTURE 02: INTRODUCTION TO ENGINEERING DRAWING -II

Hello everyone, welcome to our Engineering Drawing and Computer Graphics course; we are in module 1 and lecture 2 in Introduction to Engineering Drawing.

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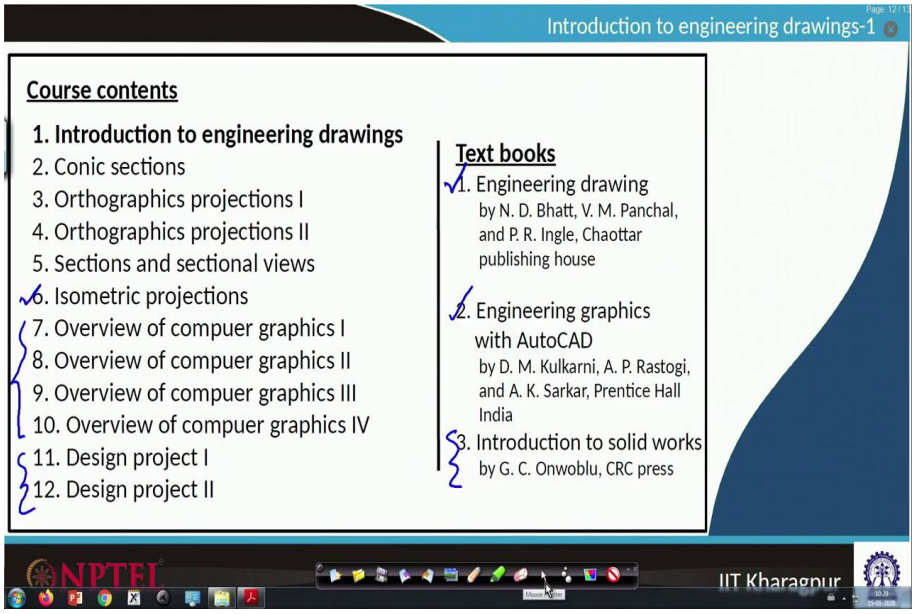

To briefly recap our course contents are an introduction to engineering drawing and conic sections, orthographic projections, sections, isometric projections, an overview of computer graphics in this part we will cover, and a design project. Our standard textbooks are Engineering Drawing by N.D. Bhatt and Engineering Graphics with AutoCAD.

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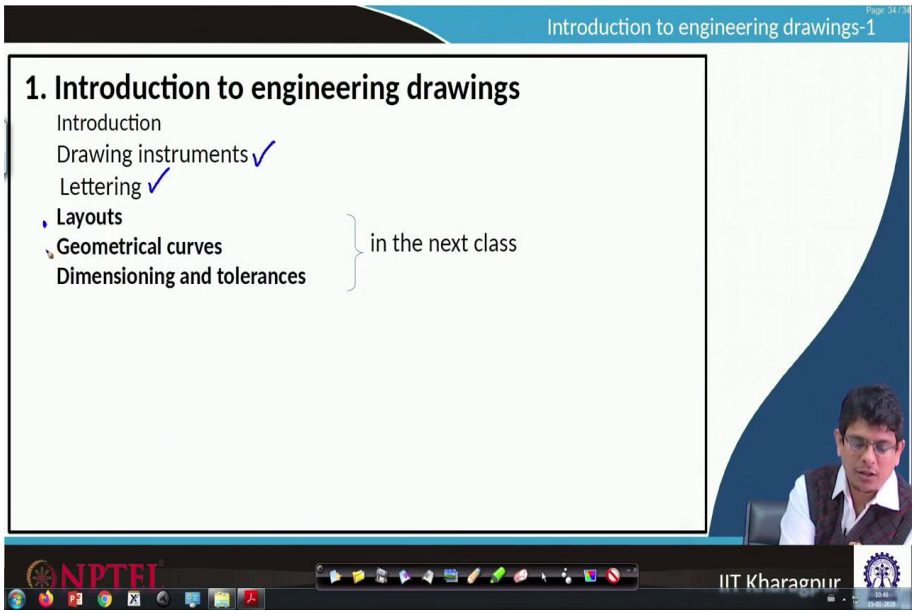

And when we are learning about computer graphics, we use an introduction to solid works, in the first part introduction to engineering drawings. In the second lecture, we cover drawing instruments and lettering used in our drawing course.

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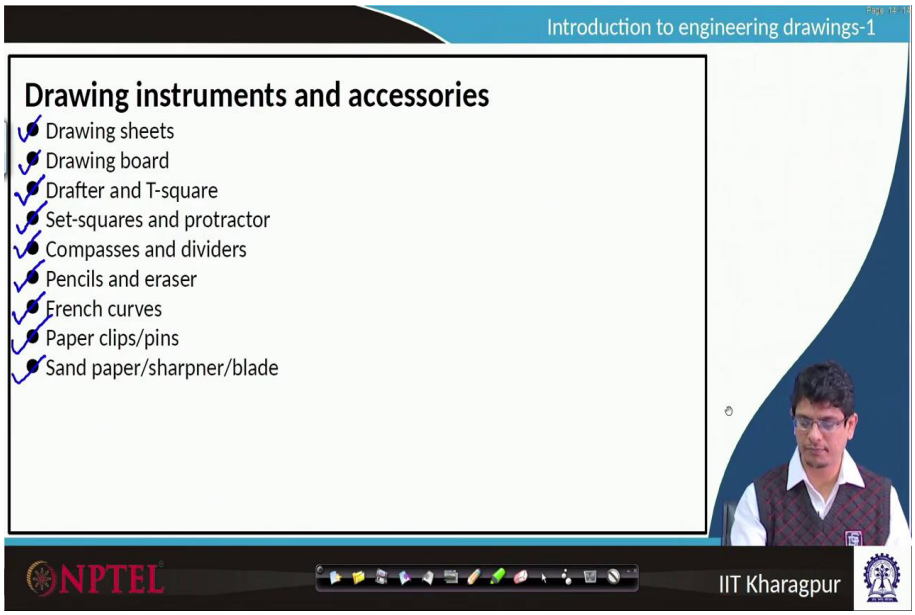

The standard drawing instruments and accessories used are drawing sheets, a drawing board to cover drawing sheet, a drafter or a T square, set squares, and protractor; occasionally, we use compasses and dividers also. The essential part of a drawing is pencils and eraser; rarely, we use French curves to connect points; usually, we go with freehand sketches, but required we go with French curves. To hold the paper, we require paper clips and pins; and to sharpen the pencil, sandpaper, sharpener, or blades are required.

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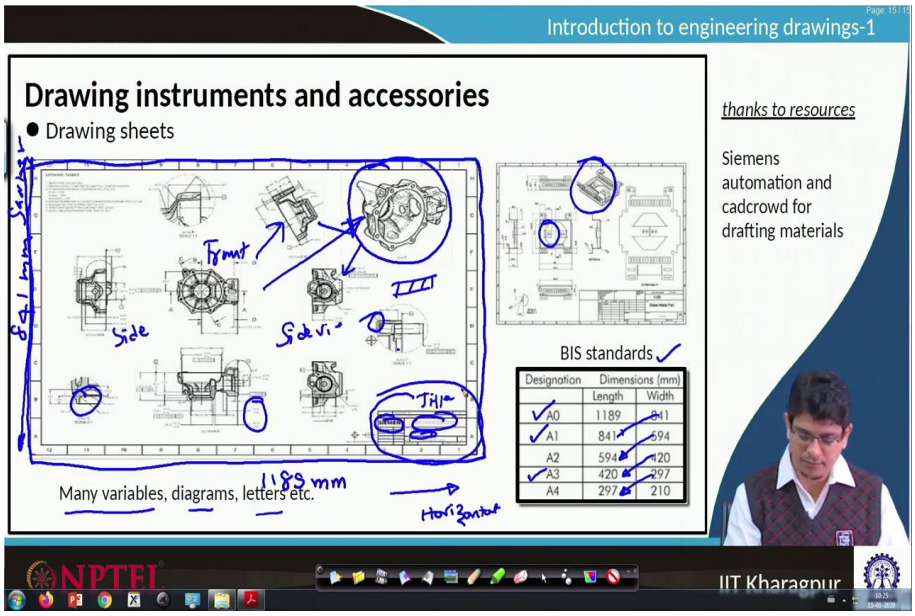

In the drawing instruments and accessories, the essential component is using a drawing sheet. Here, we can see a drawing sheet template having a certain width and a length; it is a very long rectangular sheet drawing paper. The typical standards bureau of Indian standards recommends any drawing, categorizing these drawing sheets into different formats like A0, which has a length of 1189 millimeters and a width of 841 millimeters.

Usually, we keep a longer side in the horizontal direction and the vertical shorter side. Other sheets are also available A1 i.e. 849 millimeters by 594 millimeters. So, if you are seeing, there is a diagonal repetition we can see for this drawing sheets; A2 i.e. 594mm to 420mm, A3 i.e. 420mm to 297mm, and A4 i.e. 297mm to 210mm. So, we can say this repeated pattern in the drawing sheets.

Typically drawing sheets contain the three-dimensional objects on their projections. If you are looking from the frontal view, how that drawing looks like, side views how it looks like. From the side, if we are looking at that object, that means, perhaps in this direction, how the object really looks like inclined projections and also if there are any cut sections by showing it as a hash with material portion.

And also, it might be having pins, joints, and a variety of cut sections. Those things can also be represented, and a certain kind of lettering will represent each of these parts. And we will see something like ownership of that drawing sheet; contains names and whoever so made it and the objects, properties, and so on so things; it contains many variables, diagrams, and letters.

Even for electrical engineering electronics, if someone wants to manufacture a component that component has to be represented, the dimensions, the size, the intricate details, everything has to be represented. And to summarize, a drawing sheet is the one on which we draw these sketches. And usually, we recommend BIS standards; in that drawings and title, always be there.

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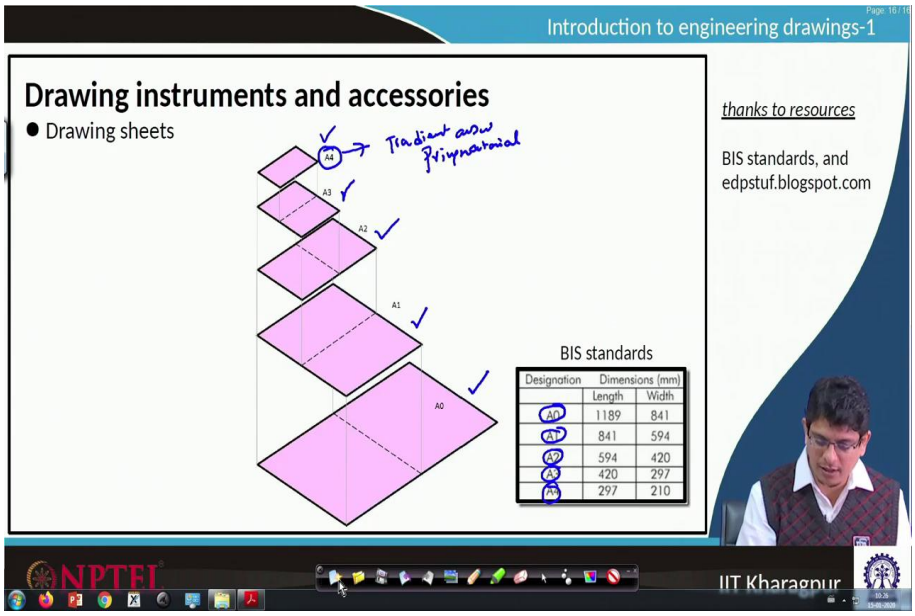

To represent the size A0, A1, A2, A3, A4 pictorially, we have represented a very long drawing sheet; half of that gives you A1, in that half gives you A2, further A3, and A4. So, A4 is the sheet that we traditionally use for writing answer scripts or perhaps printing our material; the standard page we use is this A4; with respect to A4, A0 is way large.

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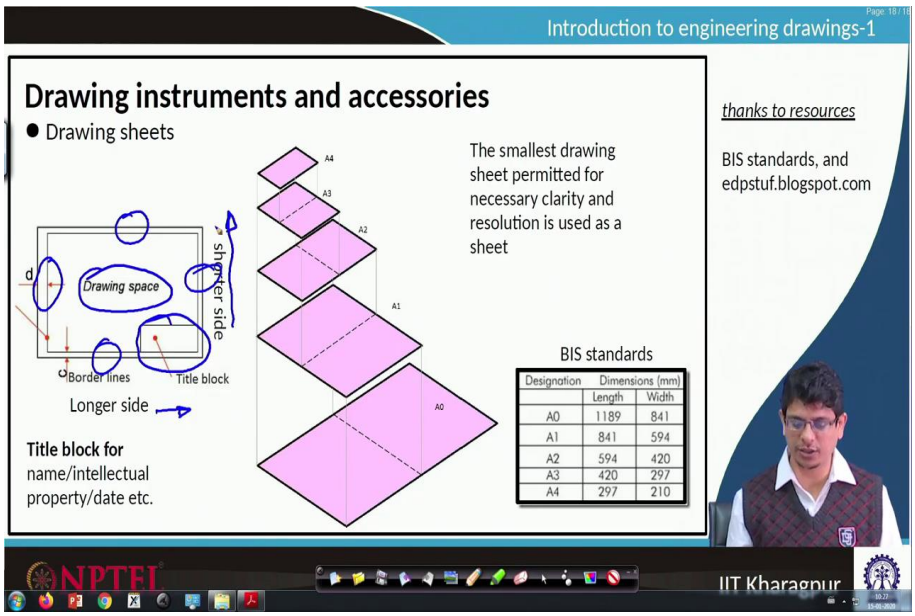

What is the best drawing sheet one should use? One has to use the smallest drawing sheet, which can give complete clarity about the drawing and resolution; that is the best drawing sheet one has to use. If the object is small and a small number of elements are involved in that, it is ok to use A2 sheet; if the object

is very large and have many components would like to give detailed expressions details, then A0 is required.

As I mentioned, drawing sheet involves a drawing space, few borderlines, and a title block; the longer side is in a horizontal direction, shorter side always be in the vertical direction.

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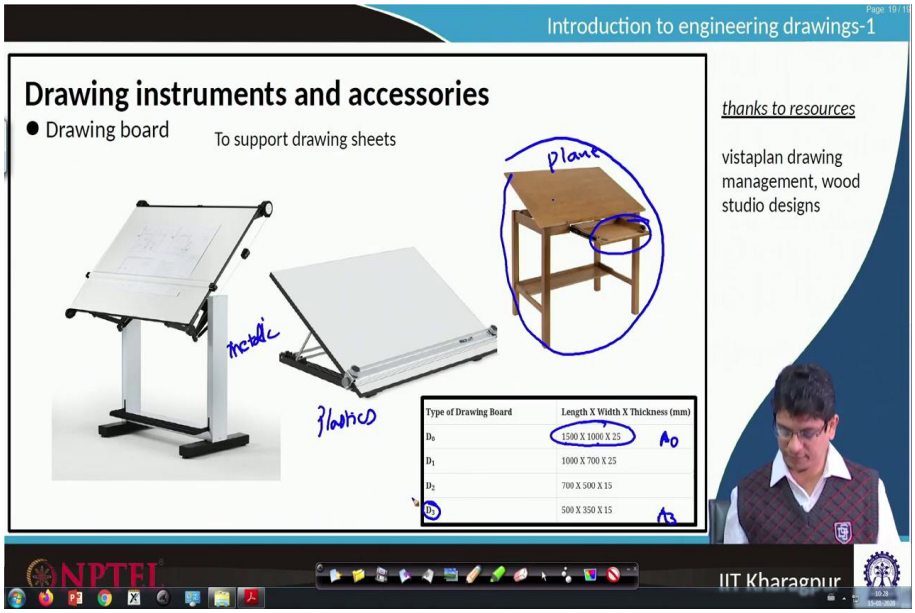

After the drawing sheet, the next one is to hold that is the drawing sheet. We require a drawing board. Here we have shown different varieties of drawing boards; the classical one is using a wooden structure. So, an inclined plane on which one will be going to fix a drawing sheet and a compartment to keep your reserves like a pen, pencils, and drawing equipment.

So, these drawing boards can be made even with metallic surfaces and also plastics. The drawing board size is always larger than this drawing sheet. For example, if we are using the A0 sheet, the drawing board size should be larger than that 1500 mm by 1000 mm width, thickness supposed to be 25 millimeters. If one uses A3 sheet, then the drawing board required is D3 size.

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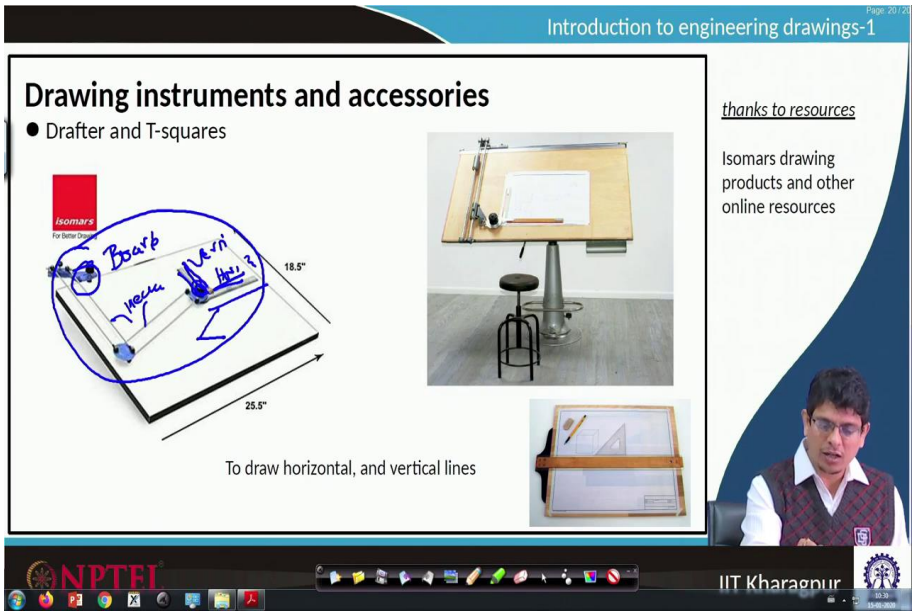

Next to the drawing table, we require a drafter or a T square for drawing lines; for example, here, a mechanical drafter has been shown. A drafter features a clamp is through which one can fix the drafter to the drawing board. By screwing unscrewing, one will be in a position to connect that clamp, and it has mechanical bars through which one will be in a position to achieve horizontal and vertical directions.

By unscrewing this, this measuring scale can be rotated and any incline direction can also be assembled. The objective of the drafter is to draw a horizontal line, in line with that drafting table or the drawing sheet. Using this drafter, one can draw complete vertical lines.

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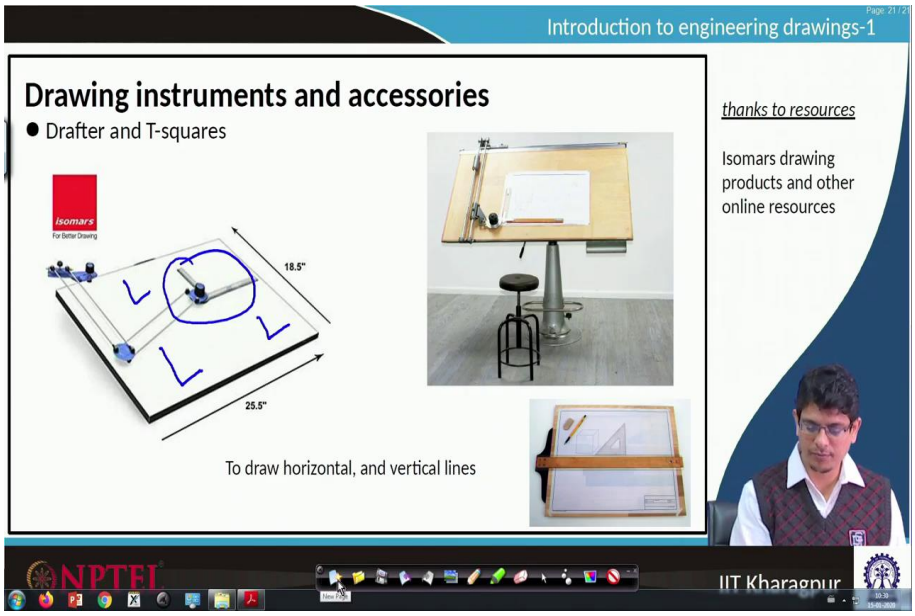

Wherever you move this drafter, it always shows only horizontal and vertical directions. These drafters can be of different types also; the simple drafter which we call mini drafter is shown here.

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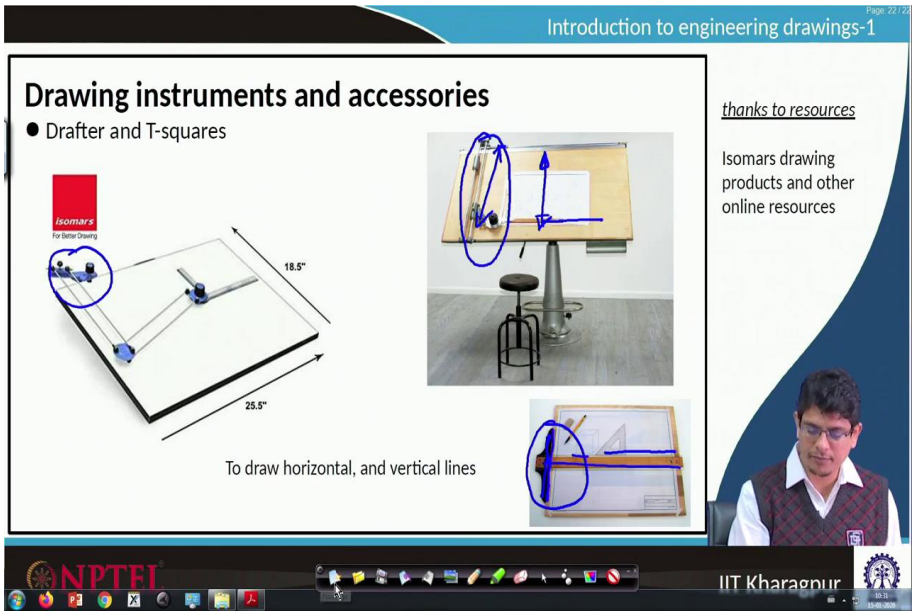

Most sophisticated drafters are also there, and those are shown here. So, these slider goes front and back, so that this horizontal, vertical lines can be drawn in that direction on the table. In earlier days, people used to go with T squares, so it is in the form of T.

So, once this block is aligned with the drawing table, one can draw a horizontal line.

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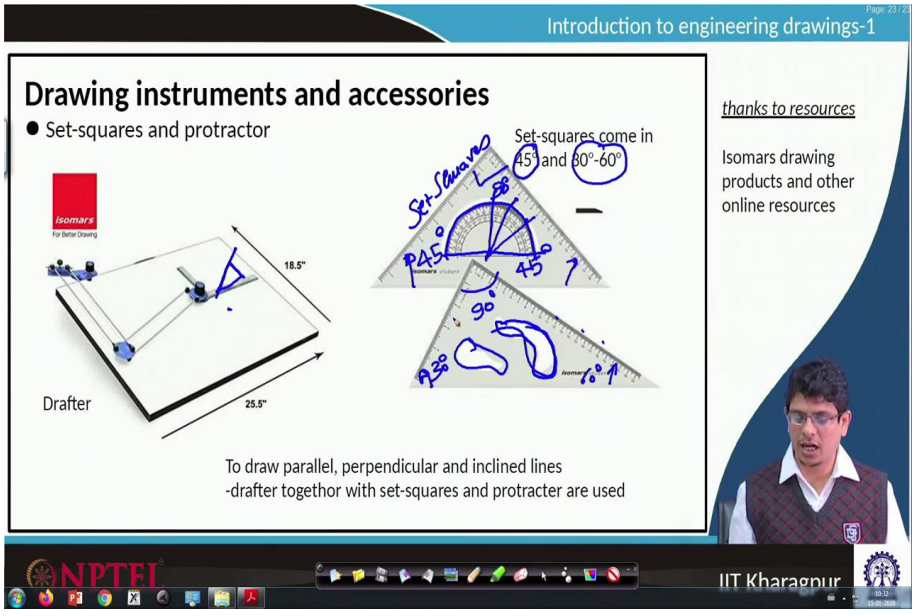

Along with drafter, the other essential components are set-squares; these usually come in 45 degrees and 30, 60 degrees, here the inclination angle is 45 degrees, and this one is also 45 degrees, and this one is 90 degrees.

If one wants to draw an inclined line with mini drafter, one will one will keep the set square there and draw a line in that direction. The other set-square comes with 30 degrees on this side and 60 degrees on this side; the remaining angle is 90 degrees; some of the set-squares consist of this kind of complicated curve patterns also.

Usually, these are acrylic plastics, so that transparent and one can note the scale and put the lines along with these slots also. The other essential component is protractor through which one can note the inclination angle made by that point. To draw a parallel, perpendicular, and inclined lines, we use these drafters and set squares.

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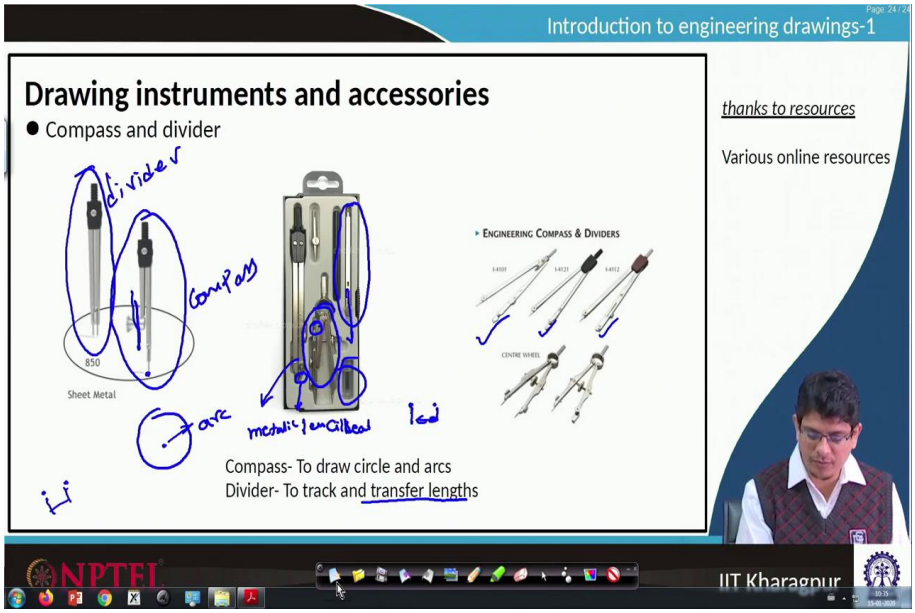

The other drawing components are compasses and dividers; the standard geometrical box consists of this compass through which one can draw a circle by keeping this object at the middle and keeping a pencil through that slot. One can draw a perfect circle an arc. The other one is the divider, using a divider, one can track and transfer lengths. For example, there are two points; instead of directly measuring what that length is, we would like to transfer the distance between that, so we use the divider.

Once that is fixed, use another point at the same location and transfer that length; further purpose, we usually go with dividers. These compasses are of different quality and also strength; the sophisticated

ones have nice metallic frames so that the grip always be good, and this is the part where pencil lead can be inserted. And this is another style of the compass, bow compass usually we call through which a lead can be kept there.

And this is a joining part of the compass, which one can insert a pencil lead. And here the pencil leads are shown. Typical engineering compass dividers come in different formats; based on the application, one uses this compass.

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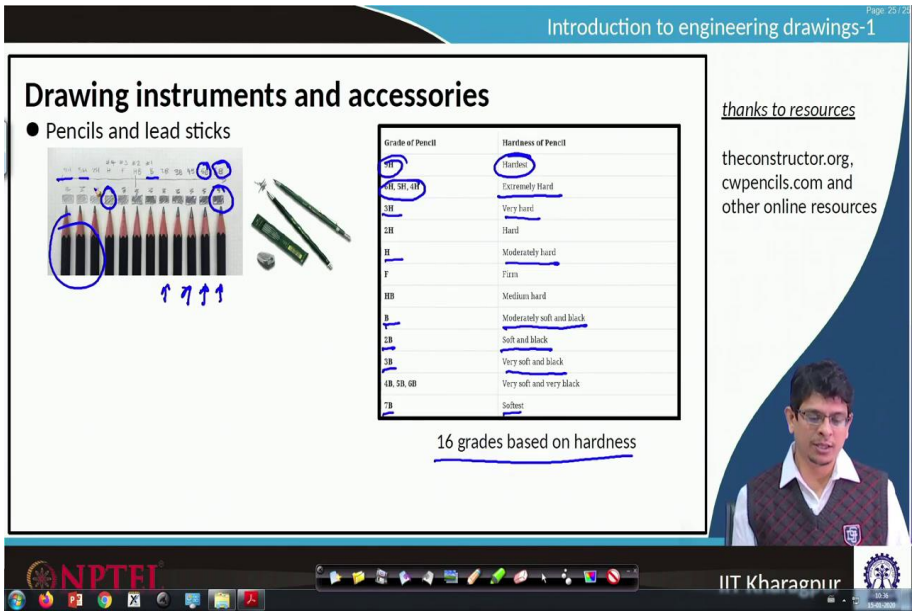

Now the key component for any drawing is pencil; compared to the ordinary pencils, the engineering drawing sketch pencils consist of different grades. Usually, 16 grades based on the hardness of that graphite lead we will use.

For example, a 9H is very hardest kind of graphite one will having 6H, 5H and 4H extremely hard; if it is 3H very hard pencil and if it is H moderately hard if it is a B type moderately soft and black, 2B pencils are soft and black, 3B pencils are very soft and black and 7B pencils softest of all. So, here on the left-hand side, we have shown different pencils like 6B, 5B, B, maybe 5H, 3H, and 4H notations; below that we have shown the color made by the pencil, the contrast made by that pencil.

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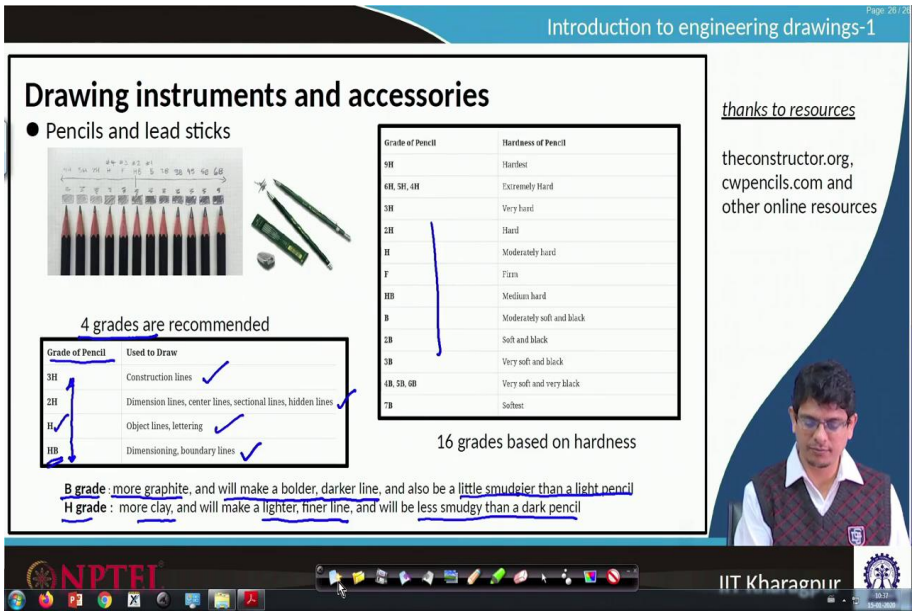

The recommended pencils for this course are these four grades; grade of the pencil where 3H, 2H, H, and HB are mentioned. And the purpose of the pencil to construct lines, perhaps dimension lines and center lines constructed using 2H; if it is object lines and lettering, it has to be done with H, and if it is something about dimensioning and boundary lines, one has to use HB pencil.

Overall, B grade pencils contain more graphite; if we are looking at the table, B always contains more graphite and makes a bolder and darker line, and these lines are little smudgier than a light pencil. Whereas an H grade pencil, if we are using it, this contains more clay, lighter and finer lines can be drawn and less smudgy than dark pencil.

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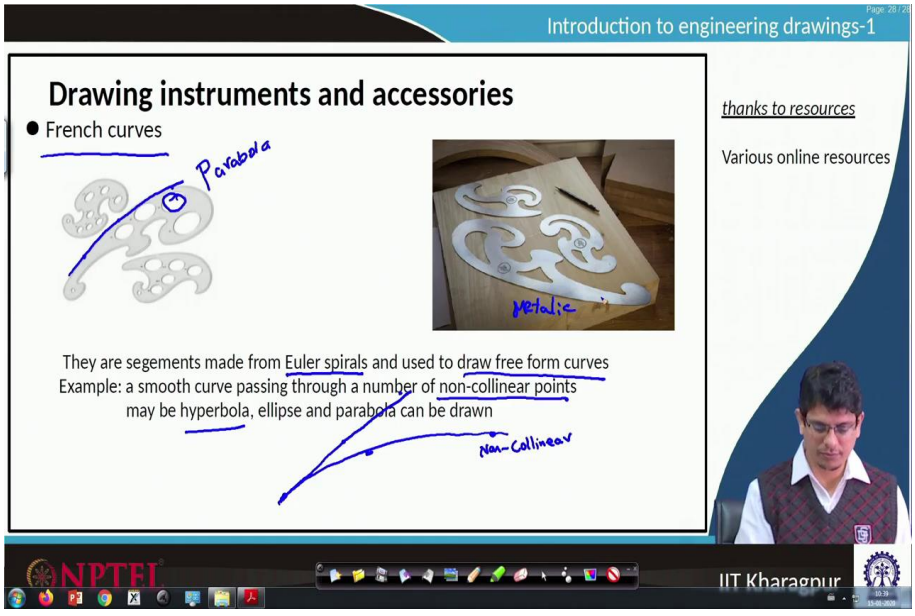

Now, we will learn about French curves; for example, if I have three data points, one can draw an arbitrary freehand sketch like that or perhaps use a French curve, so that the point can be passing through that curve and connect it by a nice smooth line.

The further purpose we require these French curves and this French curves are segments made from Euler spirals; part of the Euler spiral will be taken, and this French curve will be made and meant for drawing the free form of curves.

For example, a smooth curve passing through several non-collinear points. To represent a curve, we use French curves; usually, the longer ones are used for parabola; the shorter ones used for ellipse and the medium ones are used for hyperbolas, and it contains different elliptic curves also.

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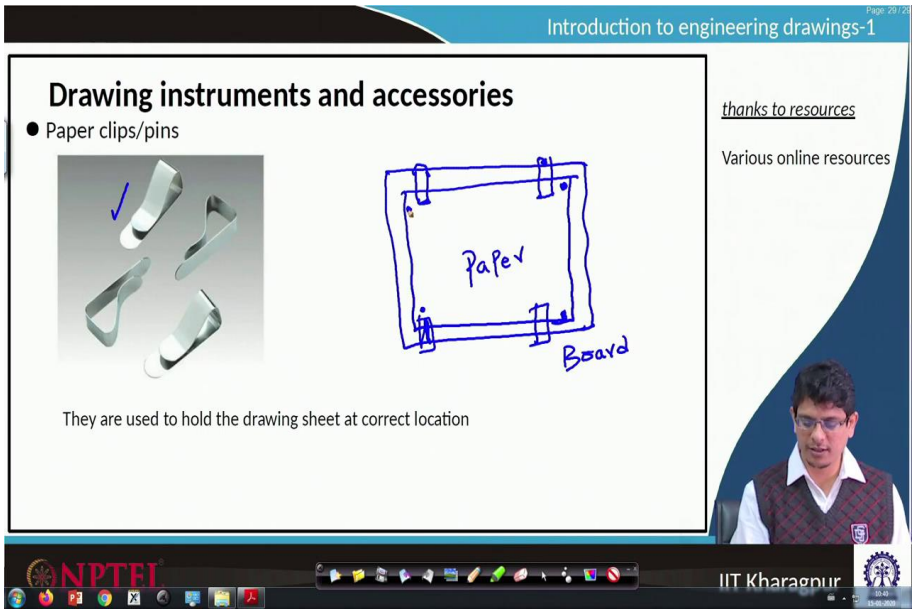

So, whenever a free form of the curve is required, we use these French curves; even for wood making and cutting, people use metallic French curves to get a nice finish. The other drawing instruments and accessories are paper clips and pins.

So, whenever we have a drawing board, to hold this is the board; we will like to hold the drawing sheet on that drawing board, this is the paper. To hold it, we use this clip arrangement; to hold it tightly, we require these clips, sometimes people use pins also.

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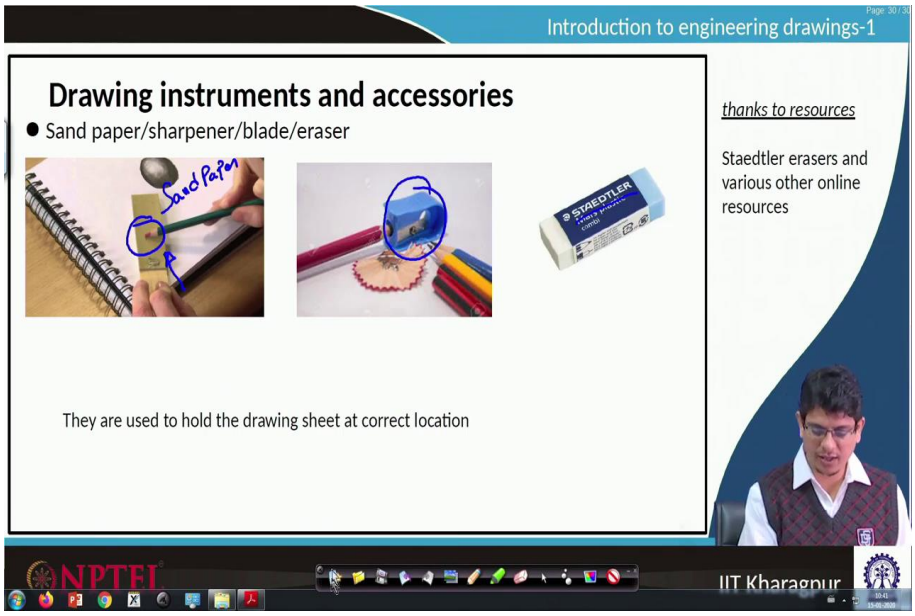

To sharpen the pencil sometimes, we require sandpaper and also to make it a bit wider kind of lines on this sandpaper, we usually rub this pencil. To have very sharp corners, we use this sharpener, and the recommended eraser is Staedtler, which always has this very smooth kind of erase.

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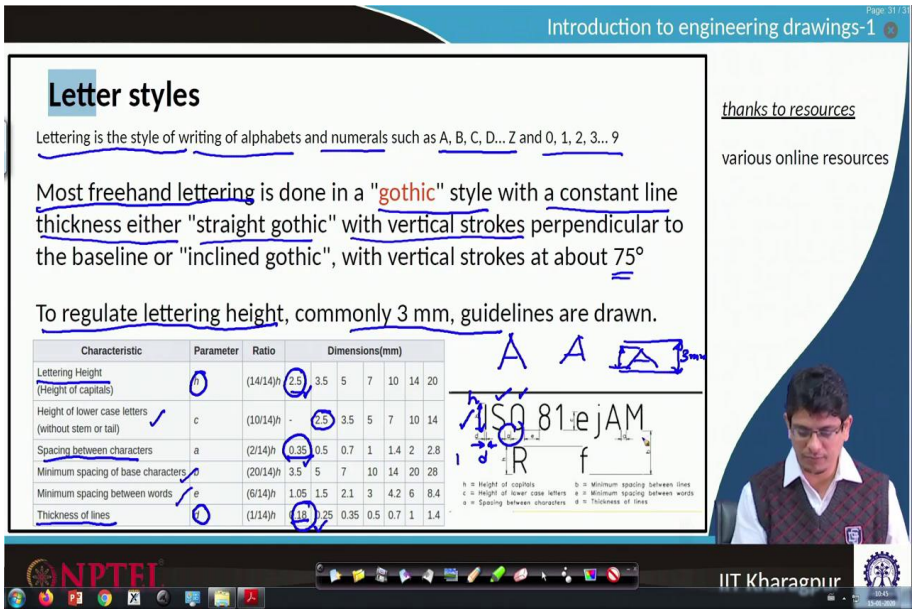

After these essential drawing instruments like bold, sheet, pencils, sharpener, clips, compass, divider, and set squares, the first objective is how to draw letters. In this section, we cover the lettering styles involved in drawing are; lettering is the style of writing alphabets and numerals. For example, we use capital letters A, B, C, D, and Z kinds of things and 0, 1, 2, 3 to 9 kinds of elements. Usually, it is recommended most freehand lettering, and that's also in a gothic style.

This style supposed to consist of a constant line, thickness either straight gothic with vertical strokes perpendicular to the baseline or inclined gothic. So, either we use straight vertical A or an inclined A; if this is inclined is supposed to be 75 degrees, and there will be a guide line, in that guide lines we draw any lettering. To regulate lettering height, commonly 3 millimeter guidelines will be used; so your letters supposed to be lower than 3-millimeters.

If it is something like lettering height capitals, we use 2.5 millimeters; if it is something like the thickness of lines, we use 0.18 mm. To understand that, on the right-hand side, we have this I letter, which is having a height of h and a width of d, so here h is 2.5 millimeters, and d is 0.18 millimeters.

Similarly, if we are using lowercase letters, one has to use 2.5 millim[eter]- 2.5 millimeters or lower than that. Spacing between characters; for example, this character and that character whatever this spacing has to be used 0.35 millimeters. If we are using 2.5 millimeters and 0.18 millimeters as the thickness, then the gap between the letter to letter is supposed to be 0.35 millimeters.

And there are other varieties like the minimum spacing of base characters, and the minimum spacing between words is also mentioned. With that kind of lettering style, we can go ahead and draw sketches and represent them.

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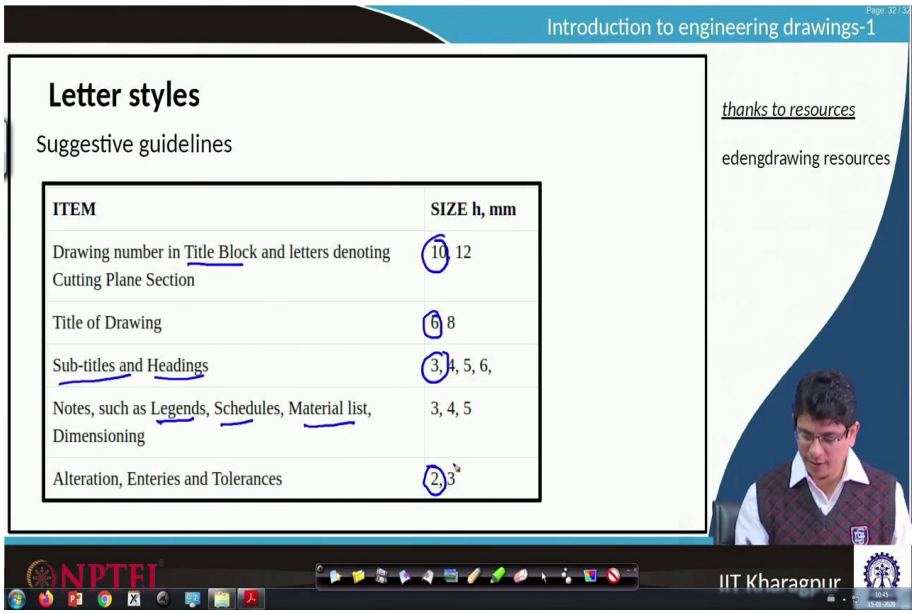

The typical letter in style involves writing it for title blocks, subtitles, headings, notes such as legends, schedules, material lists. For example, if it is title block, we use 10 millimeters kind of letters; title drawings we use 6 millimeter kind of things, any subtitles we use 3 millimeters and any tolerances and so on represented it in terms of 2 millimeters.

In today's class, we have covered drawing instruments and lettering of these drawings. In the next class, we will learn about layouts involved in drawing, the geometrical curves we can construct, and how to represent dimensioning and tolerances. See you in the next class.

Thank you very much.