Engineering/Architectural Graphics – Part 1 Orthographic Projection

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Lecture – 07
Basic Geometrical Construction

Good morning. Welcome to the lecture 2 of week 2 of this ongoing course on architectural graphics or engineering graphics and I am your instructor Avlokita. So, today we are going to revise some of the basic geometric construction techniques. Now most of these techniques all of you might have already studied, completed during your school. So, I am not going to be repeating them, but I am only going to be repeating a few which will be of common use to us in the forthcoming lectures.

So, I am just repeating some of these constructions even if it does not immediately recollect,,,,,, you are not able to recollect that kindly go back to the geometrical constructions, your school books and you would find ample of material there and I am sure you would be able to revise and recollect that. So, some of these which are expected from you is the first one that you should be knowing is how to bisect a line?

So, very simple method by using the arcs and using the ends of the lines as the centers you should be able to bisect the line that is number one. Number two, that you need to know is to draw a line perpendicular to a line at a point given in the line. So, we should be able to know how to draw a line perpendicular to a given horizontal line at a specified point in the line itself and also to draw a perpendicular passing through a point outside the horizontal line.

So we should be knowing how to draw perpendiculars to a given line in any given circumstances from within the line or from a point outside the line. Next, we need to know how to draw parallel lines so if any line is given anyways when we are working with say parallel bars or T square or the drafters we would not actually be working very hard to draw the parallel lines, but in geometric construction we should be knowing how to draw parallel.

Using the parallel bars, all you need to do is just move it up and down and all the lines are going to come parallel and if you want to make vertical parallel lines all you have to do is use the set squares and you will be drawing perpendicular parallel lines here. The next that we require is to bisect or trisecting angle. So, that is what you can very conveniently do, you can bisect an angle any given angle or you could trisect an angle as well.

So that is what you need to know and it sometimes is also used in architectural graphics. One thing which we will require which is what I am going to show you today and I am sure you already know that is to divide a line in any equal number of segments. So, for any given segment of line it would be any dimension we should be able to divide it in some given equal number of parts. It could be even numbers of parts, odd number of parts does not matter all those part should be equal.

So, that is something that we require to do because we need to know that to develop the scales. Ideally, when we are working on sheets in architectural graphics or engineering graphics we should very rarely be needing to measure the actual dimension. It should be measured only once and after that we should be able to measure it with the help of this divider or protractor.

So, that is what our intent is and then all these drawings are to scale. I always give this example if we have to draw the drawing of a room, huge room say 10 meters / 5 meters room. Now how possibly can we actually draw it here we cannot draw it at the true scale. So, we have to make it using a scale at certain ratio so we would say 1 is to 100. So, which means that one centimeter on paper will be equal to 100 centimeter in actual it could be any scale for that matter.

That scale needs to be made using this division of line. So that is what we are going to see. Then you need to know how to draw equilateral triangles, you need to know how to draw squares and we also need to know how to construct regular polygons. Now, this is another thing which we are going to see here I am only going to tell you a special alternative method of drawing polygons.

I am not going to tell you how to draw each polygon separately. There are special construction methods for each polygon. So, you might be knowing how to draw a hexagon, you might be knowing how to draw a pentagon, but I will only tell you one method with which you can draw all regular polygons possible for a given side dimension. So, these are the two things that we are going to be drawing today, learning to draw today and that is what I am going to show you on the sheet.

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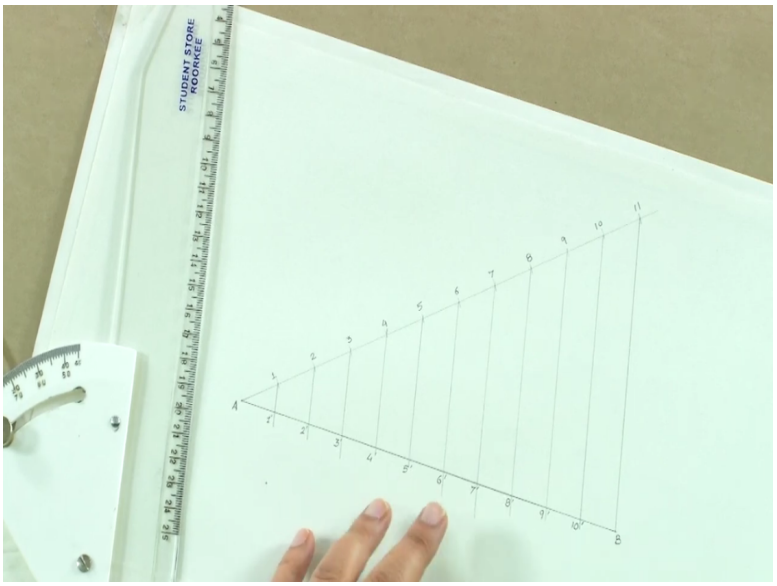

So, the first thing that we are going to do is learn how to divide any given line into equal number of parts. So, I will just take any representative line so I am taking a line which is equal to say around 20 centimeters. So, I have measured a line of 20 centimeter here. Now, this line of 20 centimeters is supposed to be divided into equal 11 parts. So, just imagine how would you divide a 20 centimeter line into 11 equal parts.

So, what would we do here is we would draw a line at any given angle inclined preferably acute. So, we would draw a line at an acute angle from this given line. Now, we have to divide this line into 11 equal parts. So, to divide this line into 11 equal parts while we are drawing this line which also could be of any given length. Since we have to divide it into 11 equal parts I am just assuming that we take it to be say 22.

Now what we have to do here is we will take a compass and on this compass I measure say 2 centimeter I do not need to measure honestly you could take any measure each of these could

be of any measure, but taking a whole figure just helps little bit. So, all we have to do is starting from one point we will mark 11 segments. So, every time we cut a segment on this line.

So, equal segments are going to be marked here 3, 4 5, 6, 7, 8, 9, 10 and 11. So, now we have these 11 equal parts on this inclined line does not matter what is the angle, what is the length it is not really a concern. All we have to now is we have to join this line the end point of the first line, the given line with the end point of this last segment. We fix our adjustable set square such that we are able to draw parallel lines.

So, now all we have to do is connect this. So, what I have done is I have connected the last point of the given line to the last point on the new inclined line and next I am just drawing parallel lines passing through those segments. So, what we have actually doing is we have divided a given length of the line into any given number of segments and they will all be measured equally.

So, this is the simple method of dividing a given line say A B. So, A B has now been divided into 11 equal parts with the help of this line. So, we divide it this inclined line into 11 equal parts whatever number was required from us and we got the same number here. So, we got the same number of divisions here by just connecting these and it is a very simple technique. It is a no fail technique which is what we are going to use while drawing the scales and this is the 11th division.

So, this is the first geometrical construction technique which we need to know because the next lecture will require us to draw the scales. So, that is the first thing.

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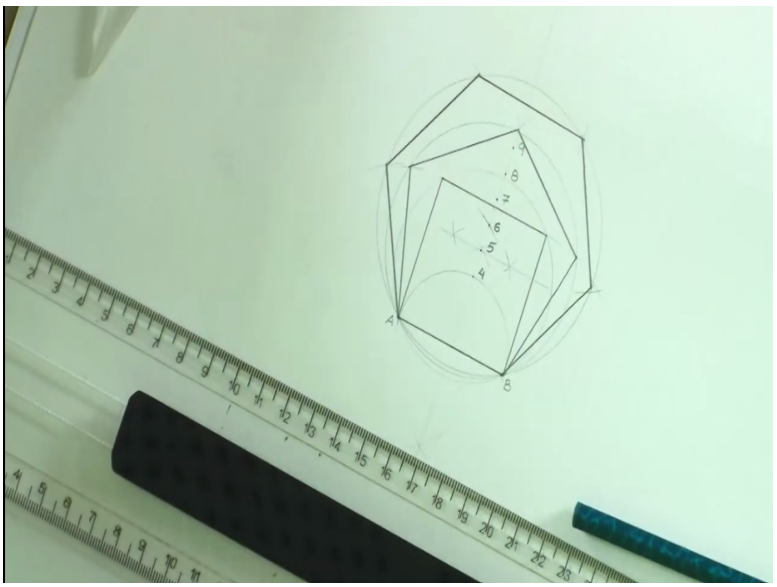

The second which we need to know is how to draw a regular polygon for a given side. So, just assuming that we have a given side of say around 4 centimeters. So, I take a side, draw a side of 4 centimeters. Now please follow the steps of construction carefully. This is a line, any line given here horizontal line and this is the side. Now, I am required to draw a square of 4 centimeter side or a pentagon of 4 centimeter side, hexagon or whatever maybe required to draw we can draw on the same line.

So what do we do for this? The first thing that we do is we bisect this line. So as you are familiar with the procedure of bisecting, we just draw a very thin faint perpendicular to this given line and passing through these bisectors. Now keeping the center as the midpoint of this line and radius equal to half the length of this line here we draw a semicircle. So, we have drawn a semicircle passing through this.

Now this point which is here let us mark this point as 4 let us draw all of this as very thin. So, I am just doing it darker so that you can see, but you should be doing it very thin in your sheets. So, this point is the point number 4. Now keeping your compass at one end point and taking the radius equal to the length of the line mark another arc on this perpendicular. Now this is the point intersecting this arc and the perpendicular bisector is the point called number 6.

So, this is 4 and this is 6. Now, we have to bisect the line segment 4, 6 I will also write A and B here which was the original given line. So, this is the original given line. Now let us bisect this line between 4 and 6. This is the perpendicular bisector to the line 4, 6 and the point where both these lines intersect is the point called 5. Now, what are these points 4, 5 and 6. Before, I come to that now we can also measure this distance 4, 5.

So, we can measure this distance 4, 5 or 5, 6 because both are equal and we can just mark these points on the same line on this perpendicular bisector. So, the point next is 7 then we have 8, 9 and so on. Now, what we are supposed to do here is taking if you have to draw a square which has 4 equal sides just put the compass center assume the center as this and take the radius as 4 A or 4 B and draw a circle passing through A and B.

This is the circle which will inscribe the square. Now you take this side equal to A, B and mark these cuts here so that you get the four sides and this is what your square is going to be. So, if you join A and B to wear these arcs they intersect the circle you will get a perfect square. Now, I have to draw a pentagon so I keep the compass here, take the radius of the circle as 5 B or 5 A.

So, we have to draw the circle passing having center at point number 5 and the radius as 5 A or 5 B so we draw a circle again. Now, if I have to draw a pentagon I will take again the length equal to A, B and mark it on the circle, the new circle and all we have to do now is join these lines. So, if you join these lines with the same side as A, B and joining all these arcs we will get a regular pentagon inscribed in the circle.

So, for the same side which is A, B we have drawn a square, we have now drawn a pentagon. We can also draw a hexagon following the same process we will keep the center as 6, take the radius of the circle at 6 A or 6 B and then you can cut the sides equal to the distance equal to the length of the side A, B and then we will get a regular hexagon. Now the only thing in this particular method is that we have to be very particular about how we measure because if you shift the measurement every time there is an error it will continue to multiply.

And we would not be able to get the regular polygons. So, we should measure very carefully and in this manner you can get any regular polygons with any number of sides in it. So, if you see if you understand this process it is very easy to draw any regular polygon. So, we have been able to draw a square, a pentagon, a hexagon using the same method. The only thing you have to remember is how to arrive at these points.

So, if you have these 4, 5 and 6 then you can draw any number of sides for a given polygon. We could draw 7 which is often very difficult we could draw 8 octagon anyway this is simple 9, 10 or whatever. So, we would also be needing this sometimes when we are developing designs when we are drawing. So, we would need this division of lines and we would need this, this regular polygon as we go into the next lecture.

So, that is all in the lecture today. This second lecture of week 2 and we would go to the next lecture where we would understand what are the different types of scales which are specifically used for architectural drawing. So, thank you for being with me today in this lecture. See you again for lecture 3 in week 2. Thank you.