**Electromagnetism**
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**Lecture – 15**
**Curvilinear coordinates: Cartesian vs. Polar**

So, far we have discussed about coordinate systems that are rectangular in nature like Cartesian coordinate system.

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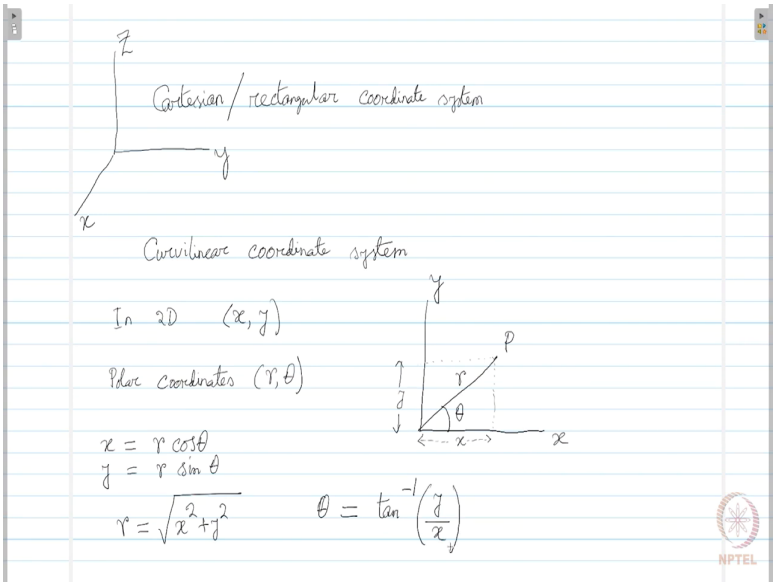


So, we had like this and this in 3 dimension these are perpendicular to each other, this being the x axis, this is the y axis and this is the z axis. Now, we are going to introduce Curvilinear Coordinate; that means, the coordinate systems where the axis are not straight lines. As a post curvilinear coordinate system as opposed to what we have earlier done was Cartesian or rectangular coordinate system ok.

So, let us consider a simple example in 2 dimension; in 2 dimension if we consider a rectangular coordinate system we will have the coordinates x and y. We can represent one point using these 2 coordinates x and y. And in 2 dimension. We can have polar coordinates represented by r and theta, where r is the distance of that point from the origin and theta is the angle it makes with some reference line.

So, if we try to represent so, here is our Cartesian coordinate system; this is x axis this is y axis in 2 dimension. And let us say we have a point here this point has an x coordinate that we can find by dropping a perpendicular from there on the x axis.

So, this happens to be the x coordinate for this point and if we drop a perpendicular from there on the y axis then this much happens to be the y coordinate for that point. In Cartesian coordinate system, we will connect the origin and sorry in polar coordinate system we will connect the origin and that point and this would be given as r and theta happens to be this angle that it makes with x axis.

That means, x will be given as r times cosine of theta and y will be given as r times sin of theta. Now, if we want to find out r and theta from given x and y we can do the following, r would be given as x squared plus y squared square root of this the magnitude. The length of this line connecting the origin and the point of interest p and finding theta is possible this way, it can be given as tan inverse of y over x; we can find theta this way.