This is Unit 2 complex numbers. The name of this module is
complex planes and physical meaning of complex quantities.
This is the outline of this module. Will see complex plane
representation of complex numbers in argand diagram.
Modulus and and argument of complex number, then physical meaning of
complex quantities. After this lecture you will be able to read
complex numbers on an argand diagram, and calculate modulus
and argument of complex numbers. In case of real numbers, we
represent all the real numbers on a number line, so that line
An infinite 1 dimensional line. In case of real numbers,
the real numbers are either positive, negative or zero. But
in case of complex numbers which has the form, z is equal to
X plus iy. It has two parts that Is real part an an imaginary
part. So we cannot represent a complex number on a normal.
Number line, so in case of complex numbers we need to
represent under root of minus one. Now this under root of minus one is not zero.
It is not a negative number another neither It is a positive number.
So instead of an infinite number line. We use an infinite number
plane to represent complex numbers. So this plane is called as an argand plane.
In the Argand plane, the horizontal. Axis that is X axis
is called as the real axis. The vertical axis is called as. An imaginary axis.
We represent complex numbers in an organ diagram.
Like we plot coordinates in a graph. Suppose if we have a
complex number 2 + 3 I. I'll see where is 2 on the real
axis and where is 3 on the imaginary axis and represent
this complex number here. This is like we're plot
coordinates in a graph note that a complex number is a single
number and not 2 numbers added together. Then we have modulus of complex number.
The modulus of the complex number is the distance of corresponding point z
from the origin in the Argand diagram. So basically, modulus of the
complex number is the length of this line. If we know the distances.
This Y an X we can find the modulus of. Any complex number Z
as mod z is equal to under root X ^2 + y ^2. argument of the complex number.
The argument of complex number. We write it as our Arg z. Argument of z is
the angle that the line joining the origin to the z.
On the argand diagram makes with the positive X axis the positive
X axis, that is the real axis. This anti clockwise direction is taken to be
positive by convention. If we know the values of Y an
X. We can find argument that is equal to tan inverse of Y by X.
Let us take an example, find modulus and argument of the
complex number. Z is equal to 2 + 3 I. In this complex number, the
value of X is 2 and the value of Y is 3. So in the solution.
The modulus is given by mod z is equal to under root X ^2 + y

^2. So we get mod z equals to under root 2 squared plus under root 3 squared, that is under Route 13. Then the argument of the complex number argument Z is given by tan inverse of Y by X. So we have Y is equal to three an X is equal to two. So we have the argument that is equal to tan inverse of three by two. physical meaning of complex quantities. Now in case of complex numbers. We make use of the fact that these numbers are BI dimensional. That is, this numbers have real as well as imaginary dimension. Now using complex numbers, we can represent rotating physical system whose real value is also changing. We have one more type of representation of complex number that is polar form. So in case of polar form we use polar coordinates that is R and Theta instead of X&Y to represent complex numbers. Now this is polar representation of complex number. This r is the modulus of. The complex numbers and this theta is the argument of the complex number. I can use trigonometry and write. This distance Y as r sinetheta and the distance X is rcostheta. So we have the general form of complex number, that is that is equal to X plus iy. I'm substituting the values of X&Y here, so we get z is equal to R costheta. Plus rsinetheta. If I take r common out of the bracket we get z is equal to R into costheta plus I rsinetheta. Next we get z is equal to R e to the power Itheta. this form is called as the polar form of complex number. E to the power I theta is equal to Cos Theta plus I sine Theta. This we get using the Euler's formula. Now in electric circuits. The voltage and currents. Changes sinusoidally with time, so we can represent them as complex numbers and represent both amplitude and phase of the variation as a single complex number. Again, in AC electrical circuits. Which contains ohmic, resistor, capacitor and inductance. We have complex resistances known as impedances. Which can be expressed as a complex numbers. So in case of the resistance R. We can write the impedance as Zr iis equal to R e to the power Itheta. So in this case the Theta value is zero. That means the phase is 0. In case of the capacitor the impedance ZC is equal to 1 by 2π FC. E to the power minus I π by 2. So in this case. The phase is minus pi by 2. So this is nothing but a complex number R e to the power I theta and similarly in case of the inductor z L is equal to 2π FL e to the power iPi by two. So here the argument theta is pi by two and the modulus is 2π FL. These are the references. Thank you.