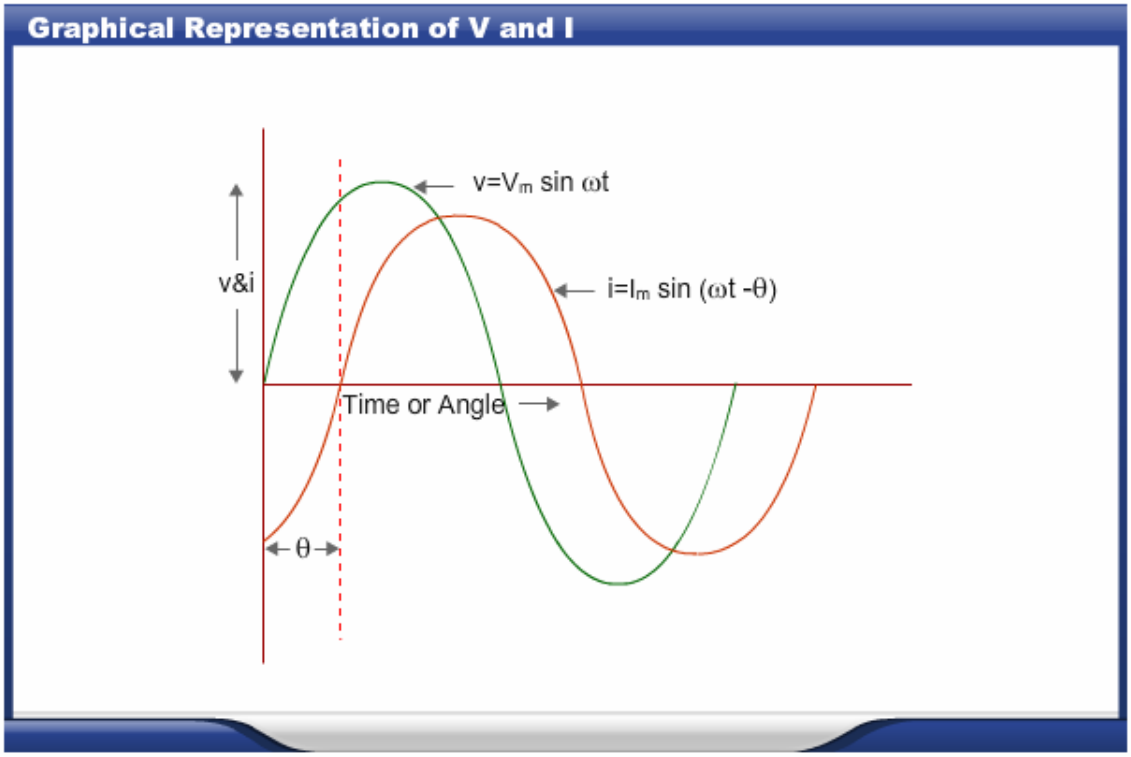
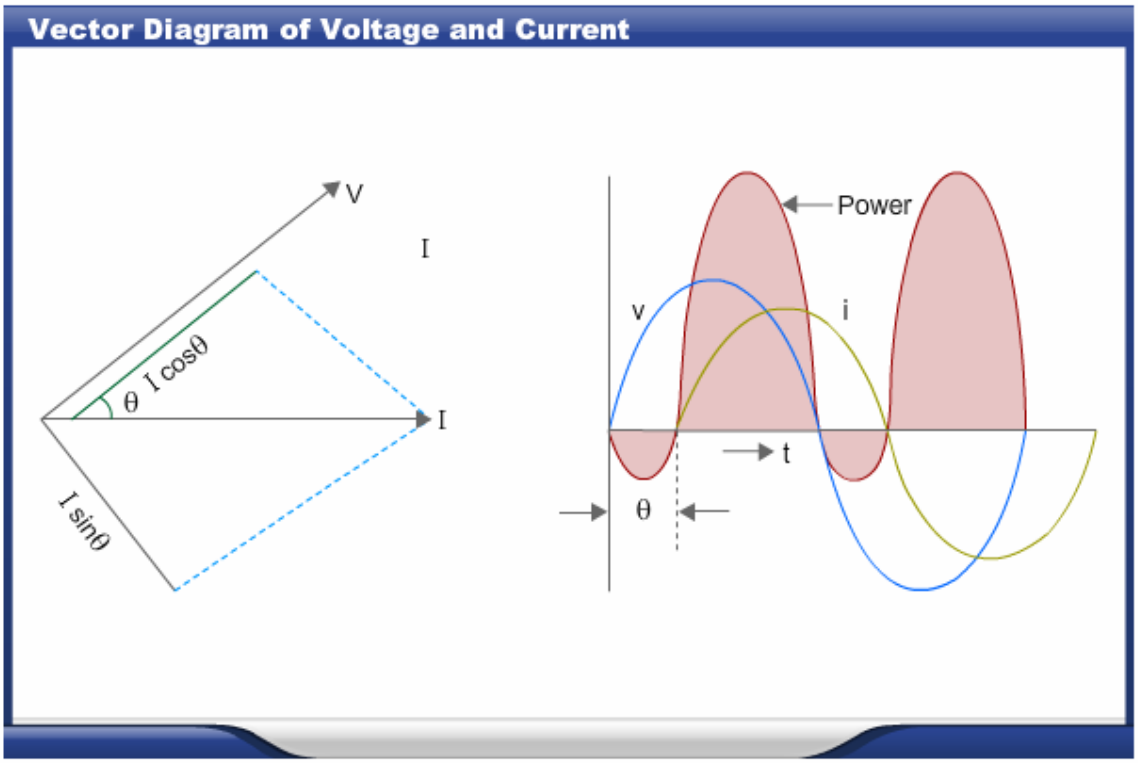
Power Factor

To understand about Power Factor, you have to consider an A.C Circuit with a load circuit consisting of resistance, inductance and capacitance. The image given below represents the voltage and currents waveforms in the circuit. It could be seen from the image given below that the current I is lagging the voltage by an angle θ. If the circuit has capacitive reactance predominantly, the current will lead the voltage.



In the image given below, the current I is resolved into its two mutually perpendicular components I.cosθ and I.sinθ.

I cosθ is parallel to the applied voltage V and I. sinθ is perpendicular with V.



The power consumed is given by the product of V and I cosθ component of the current I, which is in parallel or in phase with the voltage V.

Active Power P = VI cosθ. The term 'cos θ' is called the 'Power Factor' of the circuit. VI sinθ is called the 'Reactive Power'. This Reactive Power VI sinθ vectorially adds with the Active Power VI cosθ and the added power is called the 'Apparent Power'. Apparent power = 3 VI

The ratio of Active Power to Apparent Power is the Power factor.
Power Factor = Active power/ Apparent power = VI cosθ/VI = cosθ.
This Reactive Power is just needed to build up magnetic field in electrical equipments. This magnetic field is created and destroyed in every cycle of Alternating Voltage. The magnetic field does not do any work itself directly. The Reactive Power component or magnetic field just helps the Active Power component do the work. Without this magnetic field, electrical rotating equipments can not develop mechanical power.
Apparent power = VI.